

August 1991/\$3.00

Mobile Radio Technology

The journal of mobile communications technology



Servicing two-way portables, p. 10

• show preview/guide
• public safety communications
• cellular network modems
• mobile carrier paging

The new Midland FM Portables

*... working more
magic with
communications
technology.*

In the 80's, Midland "Syntechology" exploded forever the myth that high performance in FM mobile radios came only at high cost. Our microprocessor-controlled Syn-Tech equipment literally transformed users' dreams into reality. Now for the 90's, the genius of Midland technology has conjured up equally dramatic design and performance improvements in FM portables — a totally new generation in more than 30 configurations designed to provide the ideal, most cost-effective solution to your exact requirements.

Your wish is our command!

Choose from many task-related models to fit your application, and your budget.

- Ultra-compact, low-cost basic 2-Watt, 2-channel, crystal-controlled or programmable models.
- Tough little 16-channel synthesized portables.
- High-capability wideband models, choice of power levels: 16, 48 or 99 channels.
- Syn-Tech XTR™ ultra-performance models. 2 or 5 Watts, 16 or 99 channels. Built-in CTCSS/DCS, priority scan.
- All models meet MIL 810C/D for shock and vibration, and other environmental standards. Salt-fog, rain and dust protection standard in some models.
- Many options including touch pads, speaker/microphones, and intrinsically-safe models and accessories.



Before you buy your next portables, send for this lifesize full-line folder with all the facts.

MIDLAND LMR
LAND MOBILE RADIO
The smart way to go.

For more information, just "rub our lamp".

1-800-MIDLAND, Ext. 1690
In Canada, call 416-287-2320



Control 10 radio sites...



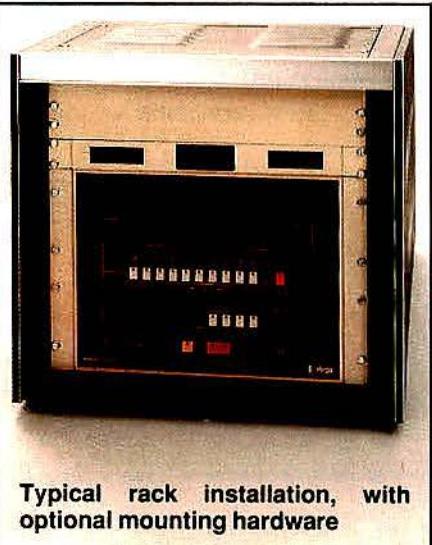
...with the C-5110 10-line/4-frequency tone console

Vega's Model C-5110 tone-format control console allows a dispatcher to quickly select one or any combination of up to 10 simplex (over 2-wire or 4-wire lines) or duplex (over 4-wire lines) remote base stations. Additionally, the dispatcher can monitor (through a second speaker) any combination of those 10 lines that are not already selected for TX/RX control.

The C-5110 console uses the industry-standard tone format (guard/function/PTT tone sequence, compatible with Vega, Motorola, GE, etc. station adapters), including function tones for selecting four frequencies (or two frequencies plus "wild card") and for the "monitor" function.

This cost-effective and versatile console includes many standard features that are usually optional even on larger, more expensive models. Standard features include:

- **TX ALL (simulcast) switch** (selects all lines for both transmit and receive)
- **RX ALL switch** for monitoring all unselected lines through the second speaker
- **Separate speakers** and volume controls for selected (TX/RX) and unselected (RX-only) audio
- **Line-activity LEDs** (indicate activity on all lines, whether or not selected or monitored)



Typical rack installation, with optional mounting hardware

- **Alert switch** (transmits audible tone with PTT tone sequence)

Options

- Desk mic; gooseneck mic; handset; headset
- DTMF pad
- Cross mute
- Clock, audio-level bargraph, and cross-mute indicators

In short, the C-5110 has the flexibility to accommodate most any multiline console requirement. With its host of features, the C-5110 is designed to meet **your** needs. Call us now at **1-800-877-1771** for full details.

Circle (4) on Fast Fact Card

Vega
a MARK IV company
Signaling Products Group
9900 Baldwin Place
El Monte, California 91731-2204
Telephone: (818) 442-0782
Toll-free: 800-877-1771
FAX: (818) 444-1342

Volume 9, Issue 8

The journal of mobile communications technology

features

10 Service tips for two-way portables

Roald Steen

Battery failures cause most of the malfunctions in portable radios. Next come mechanical failures.

26 Subcarrier communication for public safety dispatching

James M. Crooks

Consolidated county radio dispatch and "Dial 9-1-1" emergency services may include subcarrier communications.

38 Choosing the right modem for a mobile network

Barry Dorr

Part 1—Estimate the required bit rate for mobile networks to choose a modem.

44 APCO National Conference '91 preview/guide

Whether or not you visit the show, you can review products and services exhibited at the show and request information via the Fast Fact Card.

72 How to share frequencies for private carrier paging

Kevin O'Brien

Sharing RF equipment eliminates interference, ensures the fastest processing of paging messages and boosts channel efficiency to its highest level.

On the cover: Portable radios are important components in most public safety radio communications systems. See Roald Steen's article on page 10. Photo courtesy of Ericsson GE Mobile Communications.

departments

4 Editorial

Scanning...

6 Letters to the editor

Unlicensed operation.

80 News

Ten million paging subscribers.

82 ACT update

Turney leaves council.

84 Regulating technology

Reducing interference.

88 New products

Coded Communications, Magnavox and Ace Communications are the "Readers' Choice."

100 Literature

102 Feedback

Industry status nets "average to good" rating.

103 People

104 Calendar

106 Classified ads

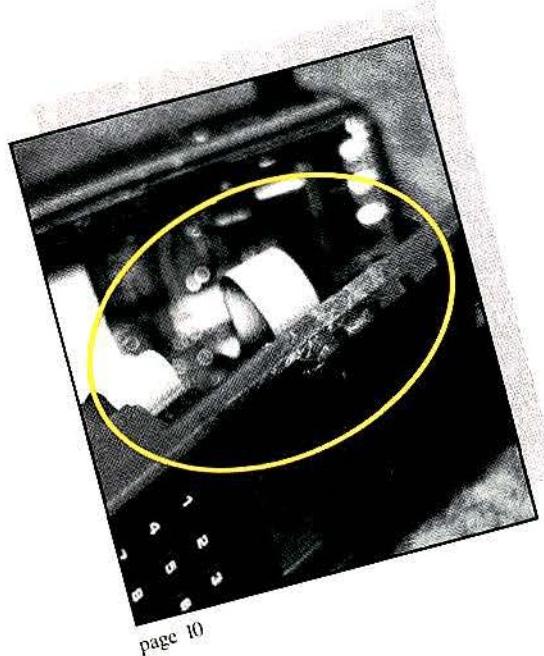
120 Ad index/hotline

Find advertisers quickly.

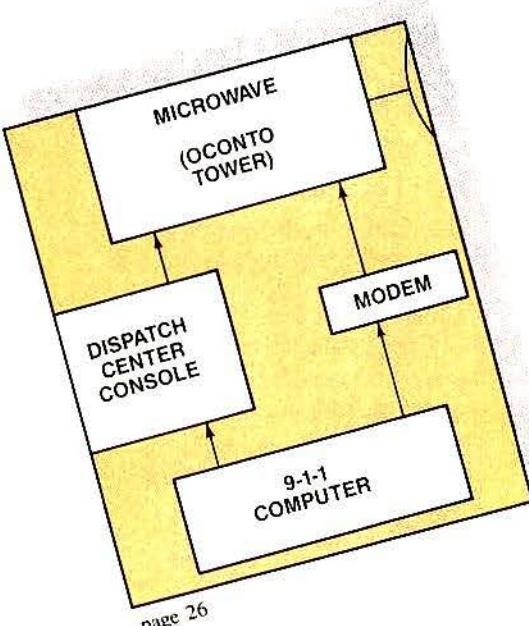
121 What do you think?

How serviceable are radios?

©1991 Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9221 Quivira Road, Overland Park, KS 66215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66212.



page 10



page 26

A New Generation of Response Signalling...



Model 364 AW
DTMF Multi-function
Decoder/Monitor/Controller

- **AUTOMATIC VERIFICATION**

audible handshake indicates completed or aborted functions

- **EASY STATUS INTERROGATION**

a touch-tone pad, voice channel and your ear is all you need

- **SYSTEM MONITORING**

audible alarms will automatically signal critical conditions

- **SSC APPLICATIONS SUPPORT**

experienced personnel will help you find the best solution for your users

- **MICROPROCESSOR FLEXIBILITY**

wide range of available controls (latched, timed, momentary, interlocked, etc.)

- **STRAIGHTFORWARD USER SELECTION**

complete manual with tutorial, demo set-up and helpful systems feedback

- **PROVEN RELIABILITY**

fully field-tested and FCC certified (class A) plus our established 5 year warranty

Call now for full information package:

800-227-1226

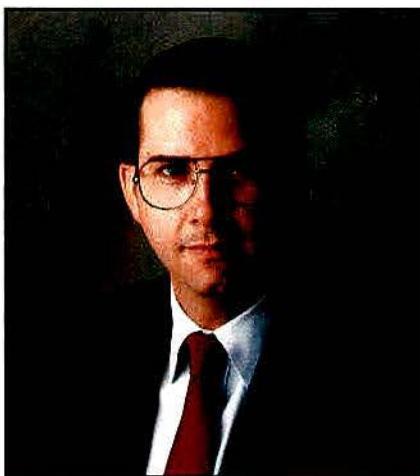
One source for all your signalling needs

SSC

SOLID-STATE COMMUNICATIONS, INC.
21060 Corsair Boulevard
Hayward, California 94545

Circle (5) on Fast Fact Card

Scanning...



220MHz applications

Not many radio spectrum developers want the FCC to use auctions to assign licenses. But the antics of radio spectrum *speculators* eventually may prove decisive where arguments based on federal revenue requirements have not.

Case in point: the 100,000 applications filed for licenses in the 220MHz-to-222MHz band. The application mills had been highly active, spewing out applications on behalf of informed and not-so-informed speculators. They hope to win licenses by lottery selection and then sell them to a lottery loser who really wants to build a radio communications system.

One possible irony in this situation is that United Parcel Service (UPS) may not win a nationwide license. An estimated 125 applications for nationwide licenses were filed, at an FCC processing fee of \$24,500 for a 10-channel system. The reallocation action that transferred the 2MHz of spectrum from the Amateur Radio Service to the Private Land Mobile Radio Service might not have come to pass if UPS had not weighed in with its comments to the FCC.

The delivery service described a channelization plan and how it wanted to use some of the spectrum for a nationwide system to support its package handling. Even though UPS filed after the comment deadline, its submission seemed to make the difference.

Radio amateurs, by the way, have been given until the evening of Aug. 27

to cease operations on the band. The exact time is 0000 UTC Aug. 28, which translates to 8 p.m. EDT on Aug. 27. Some amateur groups have planned one last flurry of activity for the frequency band's final day as an amateur allocation.

Meanwhile, a national amateur organization has filed a petition with the FCC for access to spectrum in the 216MHz-to-220MHz band. The purpose is to replace the 220MHz spectrum amateurs used for planned packet-switched inter-city relays. Many such relays will be operational until Aug. 27; others were planned. These relays support auxiliary public safety and national defense communications.

Radio spectrum battles never end.

* * *

Fleet Call

What looked on the surface like a friendly agreement among specialized mobile radio (SMR) system operators in connection with Fleet Call's plans to build low-power, multisite digital systems in six U.S. markets is unraveling.

Fleet Call ambitiously purchased 100 independent SMR operators to consolidate large numbers of channels in areas where frequencies are congested and mobile service demand is high. The company later explored options with manufacturers to use digital technology to expand its radios systems' capacity. As a result, Fleet Call asked the FCC to waive certain rules and to permit the digital system.

Subsequent meetings with other SMR operators concerned about interference and competitive factors led to an agreement under which Fleet Call filed a modified request with the FCC on June 7, 1990. The FCC later granted a waiver to cover part of Fleet Call's request and simply gave its blessing to the rest of it.

Fleet Call filed its applications on April 12 this year. The system configurations defined in the applications are inconsistent with its June 7, 1990, FCC filing. That bothers some other SMR operators. Fleet Call is bothered, too, because some applications were filed in the meantime that could preclude a full implementation of its proposed system.

If anything is refreshing about the whole situation it is that the adversaries continue to come to joint meetings and discuss their differences.

Did we already say radio spectrum battles never end?

—Don Bishop

Worried... about who's listening?

Relax . .

Cellular Privacy is here!

If you're worried about who may be listening to your cellular telephone calls then you need the CX-2100 by Transcrypt.

To protect yourself and your confidential information against eavesdroppers, scanners, industrial espionage, or the news media call Transcrypt today . . .

Economical and easy to install the CX-2100 is available with a choice of security levels for both cellular and standard telephones.

• Selected by GTE Mobilnet •

Transcrypt International is the Voice Privacy leader for Two-way radio and Cellular telephone systems.

- Law Enforcement
- Gov't. Agencies
- Professionals
- Public Safety

**Order Toll-Free
(800) 228-0226**



transcrypt international, inc

1620 North 20th Street, Lincoln NE 68503 Telephone (402) 483-2961 Fax (402) 435-6780

Circle (6) on Fast Fact Card

L

Letters to the editor

Unlicensed operation:

In your April edition's news section, the item "NABER Committee Challenges Unlicensed Radio Operation" says nothing new to me or to anyone else who has been involved in the communications business in the last 15 years or so. The problem with unlicensed users is made up of two basic factors:

- the FCC doing away with the FCC First and Second Class Radiotelephone Operator Licenses.

- the availability of programmable radios that users can purchase and then program themselves.

I see the problem with unlicensed operation. Even when licensed users do not conform to the rules, it signals the end of anyone's ability to regulate radio spectrum use.

The only possible solution is the reinstatement of some form of FCC certification for people who install transmitting equipment. When the FCC

required a license to set frequencies, the technicians policed themselves and made sure their customers did likewise under the threat of having their FCC licenses suspended.

The FCC cannot do it alone, but with the help of responsible, certified installers, the problem of spectrum piracy can be reduced greatly. Many radio dealers who previously exhibited a sense of responsibility have lost their respect for the FCC rules due to actions of mail-order vendors and out-of-the-car-trunk radio sales operations. The only solution is to put responsibility back into the system, and that can be done only with FCC certification.

It does not need to be a complete technical license, but it must be a certification based upon FCC rules and regulations and the certified individual's ability to set frequencies and other technical characteristics. NABER's or any other certification program will not work; it must be from the regulating

body, the FCC.

Each transmitter should have an identification card attached with the owner's name, station call sign, operating frequencies and the certification number of the person who set the frequencies. Local law enforcement agencies should have the authority to check for and to prosecute users who possess unlicensed transmitting equipment and the dealers who contribute to unlicensed operation.

Clarence D. Gates Jr.
Gates Radio
Columbus, IN

Amateur radio spectrum:

Thank you for your supportive article in the May issue regarding Rep. Jim Cooper's (D-TN) bill, HR 73, "The Amateur Radio Spectrum Protection Act of 1991." For information, Rep. Cooper is not an amateur radio operator.

The Amateur Radio Service has been fleeced out of 107MHz of radio spec-

Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, Editorial Director

Jane Bryant, Staff Editor

Nancy Campbell, Associate Editor

Liz Vternick, Graphic Designer

Jeri Robinson, Paste-up Artist

INDUSTRY CONSULTANT

Fred M. Link

REGULATORY CONSULTANT

Alan S. Tilles, Esq.; Partner, Meyer, Faller, Weisman & Rosenberg P.C., Washington, DC

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, President, Omnicom Telecommunications Engineering, Tallahassee, FL

R. James Evans, Communications Consultant, East Lansing, MI

Gary David Gray, P.E., Chief Telecommunications Engineer, Orange County Communications, Orange, CA

Frederick G. Griffin, P.E., President, Frederick G. Griffin PC., Lynchburg, VA

S.R. McConoughey, P.E., Mobile Communications Consulting, Gaithersburg, MD

Art McDole, Salinas, CA

F. Stuart Meyer, Land Mobile Consultant, Vienna, VA

Don R. Preure, New Smyrna Beach, FL

Herb Sachs, Herb Sachs Consulting, Bowie, MD

Leon Spencer, Radio Engineering Systems, Exxon Company USA, Houston, TX

Dr. Gregory M. Stone, Vice President, Special Projects, Live Oak Systems, McLean, VA

Raymond C. Trott, President, Raymond C. Trott Consulting Engineers, Irving, TX

BUSINESS

Cameron Bishop, Group Vice President, Mercy Contreras, Publisher

Greg Garrison, Marketing Director

Evelyn Hornaday, Promotions Manager

Darren Sextro, Promotions Coordinator

Dee Unger, Advertising Business Manager

Mary Birnbaum, Advertising Production Supervisor

Liz Turner, Advertising Coordinator

Lisa Cunningham, Classified Advertising Coordinator

Tom Cook, Group Senior Managing Editor

ADMINISTRATION

R.J. Hancock, President

Sandra Stewart, Corporate Circulation Director

Cindy Cardinal, Circulation Director

Christine Lotesto, Circulation Manager

Customer Service, (913) 541-6628

ADVERTISING: Northeast: Ruth Breashears, 303-762-1249; West Coast: Dennis Hegg, 415-491-1442; South: Diane Hiltz, 303-762-1249; Midwest: Nancy F. Matthews, 312-435-2340; Classified: Carla Gamino, 303-762-1249.

CORRESPONDENCE: Editorial, advertising and circulation correspondence should be addressed to P. O. Box 12901, Overland Park, KS 66212-0930, 913-888-4664, telex: 42-4156 INTERTEC OLPK, fax: 913-541-6697.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' representatives, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are responsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; in Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription.

PHOTOCOPY RIGHTS: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of \$2 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01980.

\$3.00 + 0.00

VBPA **ABP**
Audited circulation.

INTERTEC
PUBLISHING

©1991 by Intertec Publishing.
All rights reserved.

NEW

FLEET MANAGEMENT SYSTEM



Introducing a Fleet Management System engineered for you.

CES

1 2 3 4 5
6 7 8 9 10

Fleet Management System

Make The **RIGHT** Connection

CES

Communications
Electronics
Specialties, Inc.

931 So. Semoran Blvd., Suite 218, Winter Park, FL 32792
National: (800) 327-9956
Local: (407) 679-9440 FAX: (407) 679-8110

100
STATUS
CODES

Available In Canada from:

Omni Provincial Electronics, Inc.
East (514) 648-8432 • Central (416) 841-6740 • West (403) 291-9639

A complete system approach to fleet management for two-way radio systems regardless of size. Clear, concise, reporting of radio ID and status is accomplished through the use of a high speed digital PSK format. Instantly recognize who's calling and keep a working record with the optional computer software. To find out how this system can work for you call our sales department today.

Letters to the editor

trum since 1982 and can ill afford to lose more. In addition to your accurate observations of radio amateurs' domestic emergency communications involvement, their emergency communications capabilities once again were proven by their international traffic handling during the Persian Gulf situation.

A Kuwaiti radio amateur using a concealed wire antenna operated from a po-

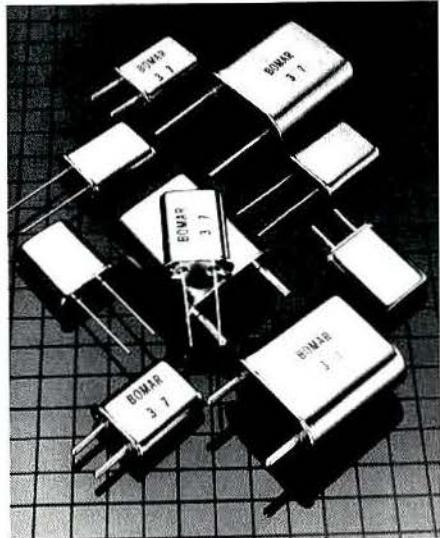
sition behind a false wall in a basement sent valuable data to the U.S. State Department. The information often was relayed by amateur radio operators aboard the *USS John F. Kennedy* in the Red Sea during the Desert Storm military operations. Messages with potentially useful intelligence information were used to confirm reports from other sources within Kuwait and sometimes

may have been the first and perhaps only source, according to the March 8 and April 4 issues of the *ARRL Letter*.

Thank you again for your supportive article. It is refreshing indeed to hear something positive from a commercial source and authority concerning amateur radio these days.

Whitman E. Brown
Mid-America Coordination Council
Golden, CO

On The Double



48 HOUR EMERGENCY ORDERS

are our specialty. Bomar delivers high performance crystals—on the double—when you need them. Technically speaking, our crystals are built rugged to last the life of the radio. And we guarantee it. Check us out. Send us your order—and we'll turn it around on the double.

BOMAR

201 Blackford Avenue
Middlesex, N.J. 08846

TOLL FREE FAX:
1-800-777-2197

CALL TOLL FREE

1-800-526-3935

Circle (8) on Fast Fact Card

Visit us at APCO, Booth #1335.

FCC investigations:

I would like more information about what the FCC is doing to improve field investigations regarding land mobile radio. I would like to see an article involving state-owned wireline companies managing specialized mobile radio (SMR) systems.

Is that supposed to be legal? Or simply a loophole in the regulations? Naturally, in our area they do not own the license but they operate, sell and manage the system. If they are forbidden to own a license to protect the small business community, why are they permitted to operate and manage systems? For me, that is the same as owning the license, is it not?

Wilfredo Miranda
North Sight Communications
Levittown, PR

Fast Fact Card comments:

Two of the toughest problems on the job are:

- the lack of service literature and schematics that show "pin-outs" but not the functions of integrated circuits.
- the lack of qualified newcomers to the mobile radio field.

Marc W. Von Wellevee
Zee Tronics
Middletown, OH

The toughest problems on the job include:

- obtaining radio channels in urban areas.
- working with funding restrictions and rules in public agencies.

Carroll White
Communications manager
Port Authority of New York
Huntington Station, NY



DON'T MOVE...

TO DIGITAL SECURITY

**Meet the "Top Gun Scrambler"
For the Radius™ P200
and Motorola® HT600***

Cypher-MXTM VSB

The Cypher-MX Variable Split Band Scrambler is close to digital in security, but without the drawbacks of processing delay, lost speaker recognition and reduced range. The MXP1283 is an SMT/PCB module housed in a replacement front cover for either a Radius P200 or Motorola HT600. And in a showdown, Cypher-MXvSB is quicker to install.

For Straight Shooting Information

**Call Toll Free:
1-800-638-5577**

MX-COM, INC.

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054

In Canada Call Omni Provincial Electronic, Inc.:
East / 514-648-8432 • Central / 416-841-6740 • West / 403-291-9639 or 604-589-3822

* Motorola and Radius are trademarks of Motorola, Inc.

Circle (9) on Fast Fact Card





Service tips for two-way portables

Battery failures cause most of the malfunctions in portable radios. Next come mechanical failures. Once those problems have been ruled out, electronic troubleshooting begins. Here are some steps to follow.

By Roald Steen

Portable two-way FM radio transceivers often are subjected to abuse. Such radios are used by police officers, firefighters, construction workers and others who spend much time outside. Police officers and firefighters, especially, often work in situations where the care of their portable radios is not the primary concern.

Portable radios may be dropped, banged around and left in vehicles that may become extremely hot in summer and cold in winter. They may be splashed with water and other liquids and even immersed.

Steen is an electronics instructor and a two-way radio technician who lives in Woodbury, MN.

Special skills, equipment and procedures are necessary to fix portable radios. Wires, circuit boards, solder joints and switches are small and difficult to remove. Isolating a problem can be challenging.

Logs

Keep a log for each portable radio you service. When the radio comes into the shop, log the complaint that accompanies it.

The log will be especially helpful when the radio suffers from an intermittent fault. Intermittent faults sometimes are difficult to duplicate in the radio service shop. A log helps you to determine whether a given type of radio has similar recurrent problems.

Battery

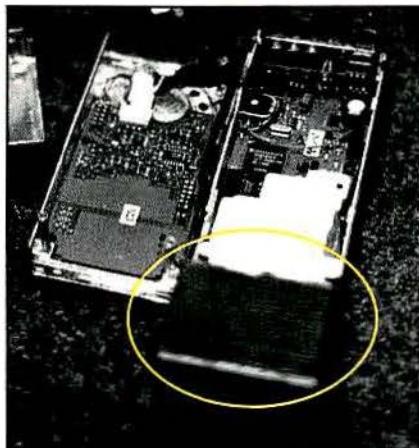
Most portable radios are powered from a small battery that attaches to the radio. Although alkaline batteries some-

times are used, nickel-cadmium (NiCd) batteries are more common.

Battery failure is the most frequent cause of portable radio malfunctions. NiCd batteries gradually lose their ability to hold a charge during use. Battery exercisers and other systems are used to improve the performance of worn NiCd batteries. The improvement that results from exercising a battery by running it through one or more discharge-charge cycles may be temporary.

In extremely cold weather, NiCd and many other types of batteries work poorly. It is wise to shelter batteries from severe cold. Low temperatures normally do not damage a battery. Instead, they temporarily reduce a battery's ability to supply current. Warming the battery restores its capacity.

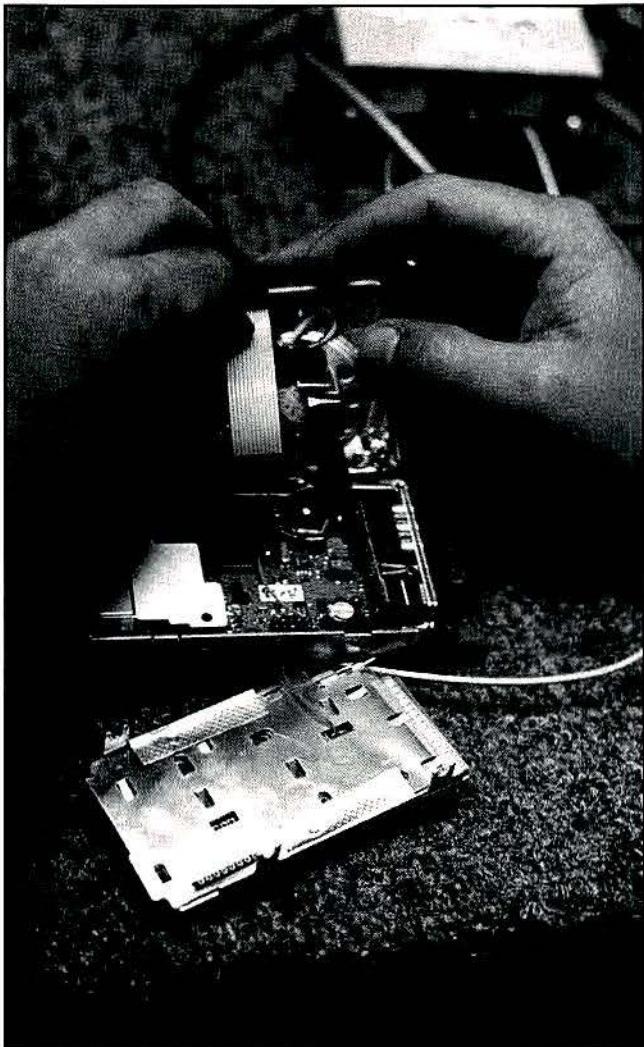
When you replace a defective NiCd battery, return it to the manufacturer. The manufacturer may be able to recycle its component materials. NiCd bat-



The simulated battery connector applies power to the portable.



The power supply is adjusted to apply 12Vdc to the portable. Maximum current is limited to reduce damage if the portable has a short circuit.

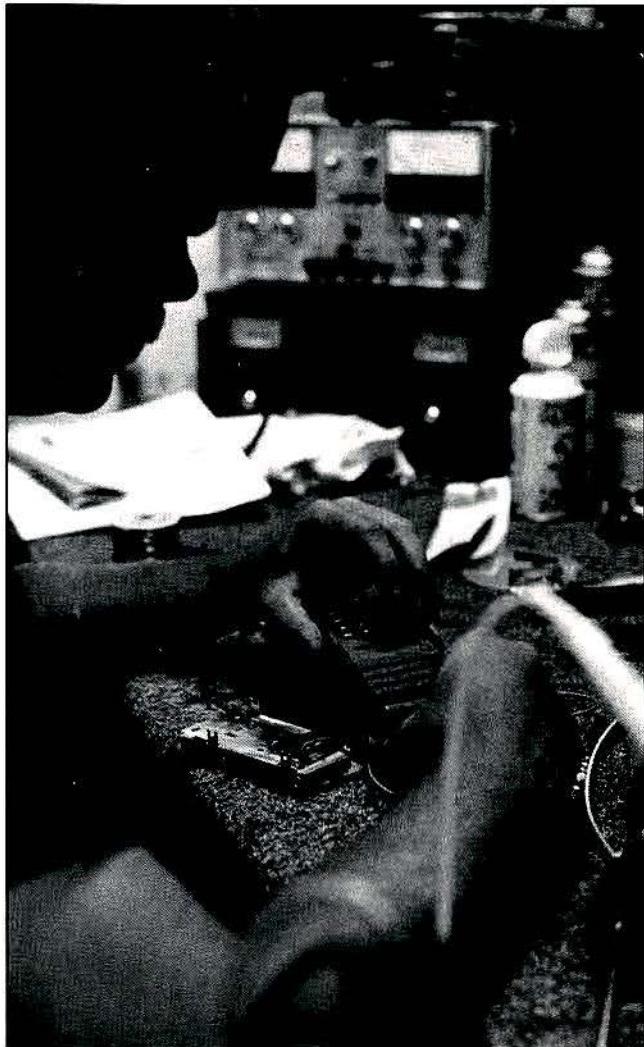


Jumper cables are put in place to connect halves of the portable that are separated when the unit is disassembled, disconnecting plugs and sockets on the printed circuit board that fit together.

teries should not be disposed of as ordinary waste. Cadmium is toxic, so it should not be allowed to enter the environment through disposal at a land fill

or incinerator.

Once the battery has been verified to be in satisfactory condition, the next step is to apply power to the portable



With jumpers in place and power applied to the portable, technician Greg Adams of Independence Communications, Independence, MO, observes that the liquid crystal display functions normally.

and observe its operation.

A small supply that converts ac power to dc power is used to power the portable on the bench. Adjust the power

Securitron

Model 813A

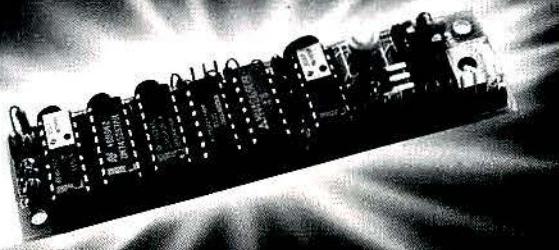
Radio
Station
Identifier

Now there is a compact, affordable Morse code identifier that's perfect for Common Carrier, Maritime, Aviation, Land and Amateur radio identification. Introducing the Securitron Model 813A.

The Model 813A features multi-mode operation, field replaceable memory, adjustable audio and programmable code speed, tone and repeat interval ... all in a rugged miniaturized design. For complete details on the Model 813A, contact Securitron today.

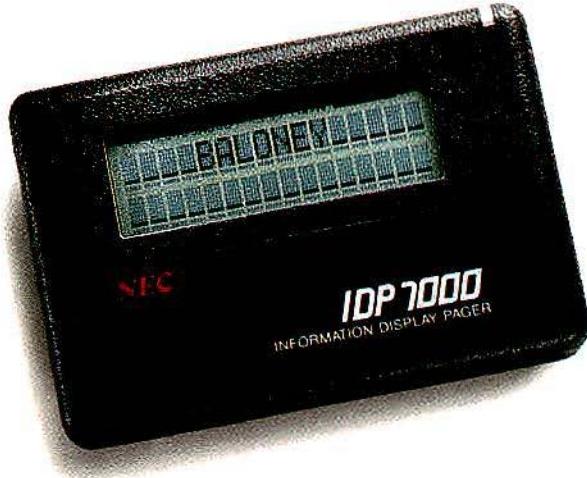
(408) 263-6434

Securitron Company • P.O. Box 32145, San Jose, California 95152



Circle (10) on Fast Fact Card

A SHORT MESSAGE FOR THOSE WHO THINK ALPHANUMERIC PAGERS HAVE TO BE COMPLICATED.



It doesn't get any easier than the NEC IDP 7000 alphanumeric pager. One button, one touch operation controls most of its functions. And while it's simple to use, the data it provides is anything but.

More than numbers and names, it provides complex information like stock quotes, directions, memos—even weather alerts.

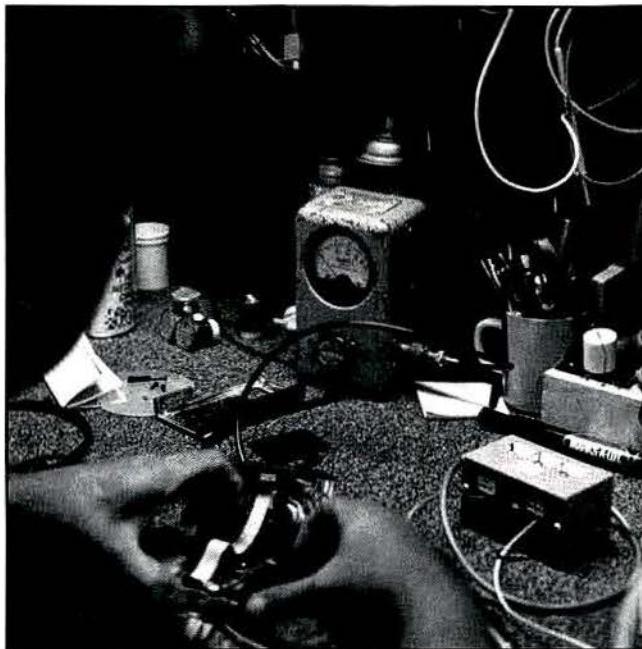
Specific messages of up to 32 characters are easily read on a recessed screen that's twice as large as its nearest competitor.

The IDP 7000 is also easy to sell and service. It even has a unique remote control capability that allows you to suspend and resume service.

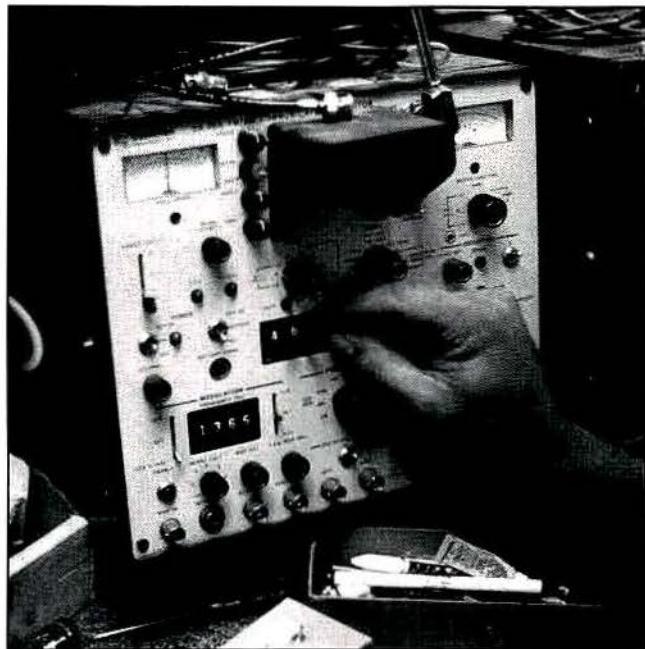
Standard bells and whistles include a large 7000 character memory, a battery backup, automatic display illumination, an available memory indicator and alert modes.

For your customers who want sophistication without complications, the IDP 7000 is an easy sell. And that's no baloney.

© 1990, NEC America, Inc.



With a length of coaxial cable, Adams connects a wattmeter to the portable transceiver's RF output. Then he presses the PTT button to measure the transmitter output. The meter needle does not deflect, indicating no power output, but the transmitter may not be defective.



Adams sets service monitor thumbwheel switches to tune the portable transceiver's transmit frequency. When he once again presses the transceiver's PTT button, the service monitor picks up a signal from the unit, indicating the transmitter is at least partially operational.

It will snag the scoundrels.



Digital ANI

Introducing CSC's ID-33 Encoder for Automatic Number Identification—This state-of-the-art, subminiature ANI board will stop the horseplay and end the stuck mikes. It includes a time-out timer and emergency/status messages as well as ANI; transmits the ID in a mere 100 milliseconds. Fleet prices from \$69 to \$145. Call for brochure.

CSC CONTROL SIGNAL CORPORATION

1985 S. Depew St. #7 Denver, CO 80227 (303) 989-8000

CALL TOLL FREE 1-800-521-2203

Circle (12) on Fast Fact Card

**\$13K³ Year
Warranty**

The New STABILOCK® 4015 Radio Test Set Tests Great-Less Weight

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

The STABILOCK 4015 packs a lot of features in a compact design:

- spectrum analyzer with audio
- electroluminescent display for easy viewing night or day
- licensed CLEAR CHANNEL LTR® testing capability
- memory cards to load and run tests automatically, including all cellular formats
- digital storage oscilloscope
- internal battery

Lighten your two-way test load today—call for more information on the STABILOCK 4015:

1-800-225-5765 (in MA: 508-671-9700).

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies

**Quality Test Solutions
Schlumberger Technologies**



**Schlumberger
Technologies**

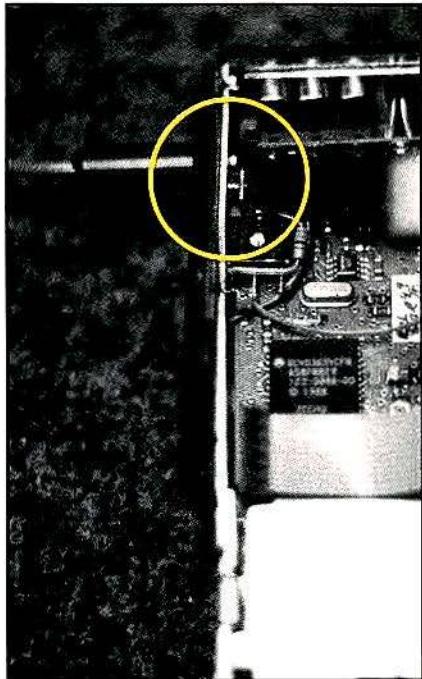
Schlumberger Instruments
P.O. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 544433
Fax-44 252 543954
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Ingolstädter Str. 67a
D-8000 München 46
West Germany
Phone-49 89 31889-0
Fax-49 89 31889-160
Telex-5215015 SMG D.

Circle (13) on Fast Fact Card



Lack of RF output despite a received signal on the service monitor draws attention to the RF output jack.

supply to deliver the voltage the portable normally would receive from its battery. Set the supply's current-limiter so the radio cannot draw excessive current if it has a short circuit. Connect the power supply to the portable using a connector that simulates the battery connection.

Troubleshooting

Use a radio service monitor and wattmeter to check the portable radio.

On each channel, check the transmitter for modulation, tone squelch frequency and deviation. Measure each transmit channel's frequency and the sensitivity on each receive channel. Check to see whether current consumption and RF power output are within specifications.

Most portable radio faults are mechanical rather than electronic. Switches fail and may have to be replaced. The push-to-talk (PTT) button is a frequent cause of malfunctions, together with the relay, integrated circuit or transistor that performs transmit-receive switching.

Check the microphone and the speaker. These components are vulnerable, especially when the radio gets wet.

Check the antenna. A portable antenna often has some reflected power when checked on an in-line wattmeter, so an SWR measurement may not be conclusive. Most antenna problems are visible in the form of a sharp bend or other deformity. If you suspect the antenna is defective, replace it. Antennas are much less expensive than radios.

If these tests confirm that the radio is not operating properly, open its case for further investigation. Open it carefully: Small wires often found inside portable radios can tear apart easily or come loose from their solder joints.

Check the antenna connector for continuity and damage.

The radios' manual and schematic diagrams are indispensable tools. As you gain experience with a certain type of portable radio, write notes on your copies of the manual and schematics.

Among the most helpful notes are signal levels measured at various points

SCALA

PROFESSIONAL ANTENNAS for
216-225 MHZ SYSTEMS

- ✓ OMNIS
- ✓ DIPOLES
- ✓ YAGIS
- ✓ LOG-PERIODICS

FOR MANY YEARS SCALA HAS BEEN MANUFACTURING RUGGEDIZED PROFESSIONAL ANTENNAS FOR RADIO AND DATA SYSTEMS OPERATING IN THE 216-225 MHZ BAND. NOW THAT THIS SPECTRUM IS AVAILABLE FOR LAND MOBILE SYSTEMS, WE STAND READY TO SUPPLY YOU WITH ALL TYPES OF FIXED-STATION ANTENNAS AND ARRAYS TO MEET YOUR EXACT REQUIREMENTS. PLEASE CONTACT US FOR FULL INFORMATION AND PRICING.

SCALA ELECTRONIC CORP. . PO BOX 4580 . Medford, OR 97501
PHONE (503) 779-6500 FAX (503) 779-3991

Circle (14) on Fast Fact Card

When every second counts...



Count on the reliability and performance of communications consoles from Orbacom

In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbacom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbacom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-

division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



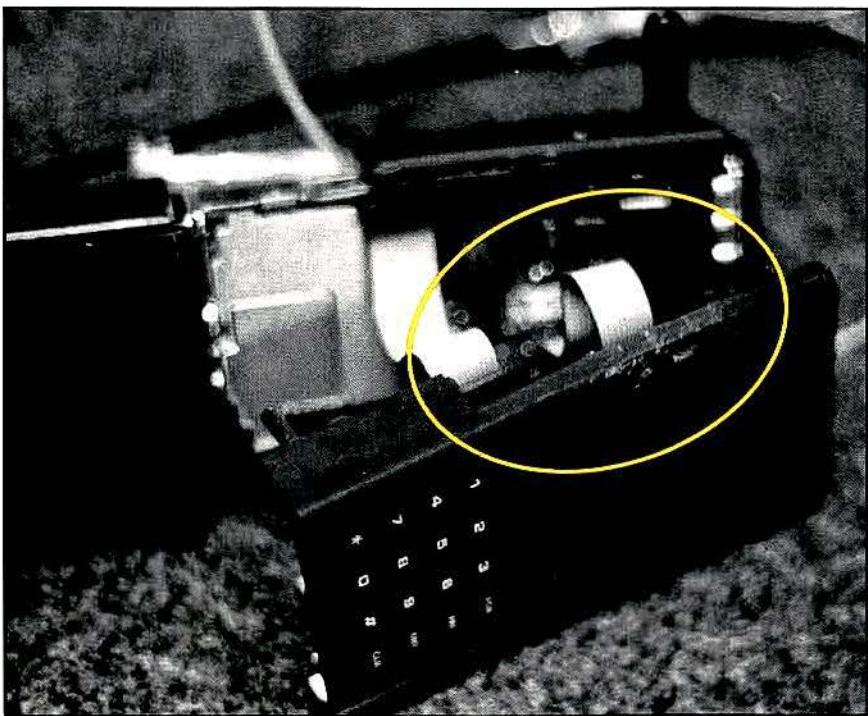
TDM-150: Our state-of-the-art, 120+ channel console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbacom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455 and let Orbacom solve your dispatching problems. Orbacom Systems, Inc., 1704 Taylors Lane, Cinnaminson, NJ 08077; FAX: (609) 829-6980.



Circle (15) on Fast Fact Card



An indication of a possible mechanical failure: The unit has been subjected to heavy abuse, as evidenced by the crushed front panel. The back panel, side panels and top panel show signs of damage, too.

and descriptions and drawings of the signal's appearance on oscilloscope and spectrum analyzer displays.

Among electronic components that cause the most frequent problems are those that pass the most current. Although modern portables are well constructed, their small size sometimes allows too little space for heat sinks and convection to remove the heat some components generate.

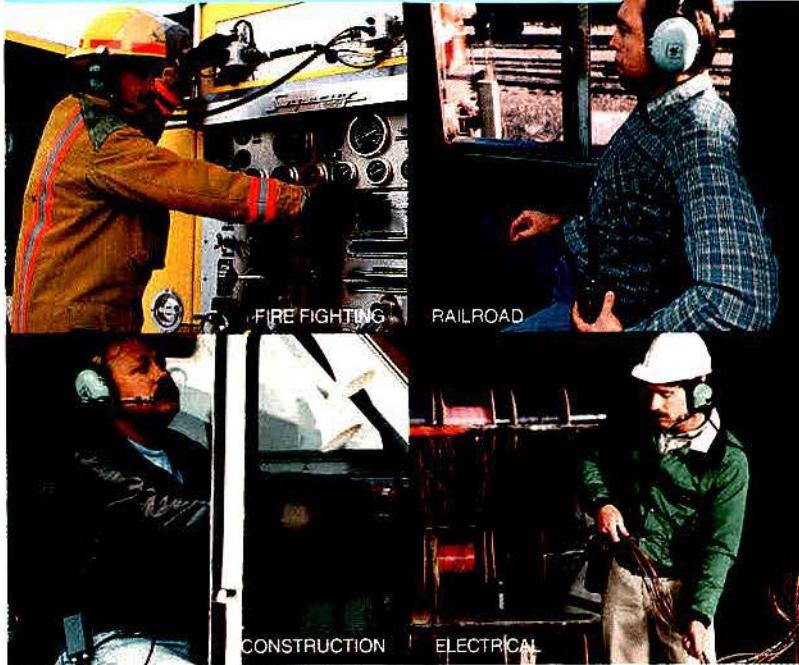
Components that pass high current include the voltage regulator (some portables have more than one) and transmitter section and audio section power transistors.

Measure voltages delivered to various parts of the radio during transmit and receive to verify that they meet specifications. Look for visible evidence of a problem, such as circuit board cracks, defective solder joints and discolorations or deformities caused by excessive heat.

Look for evidence of moisture. Use a brush to remove deposits built up by moisture.

Sometimes wet radios are brought in

FITS ALL APPLICATIONS



Wherever you look, you'll find a need for clear, reliable, two-way communication. And, if there's high noise, you'll also find the need for **Noise-Attenuating Headsets**.

All David Clark Company Noise-Attenuating Headsets feature noise-canceling microphones for clear, easy-to-understand transmissions, regardless of background noise. As mandated by the EPA, each headset is tested and certified with a Noise Reduction Rating (NRR).

Systems available for mobile and portable two-way radios:

- PTT (push-to-talk, with boom microphone)
- VOX (voice-activated, with boom microphone)
- VOX-TM (voice-activated, with throat microphone)

Also available: The Series 3800 Intercom System, with mobile radio interface.

Regardless of your application or brand of radio, David Clark Noise-Attenuating Headsets are the clear choice. Call or write for more information.

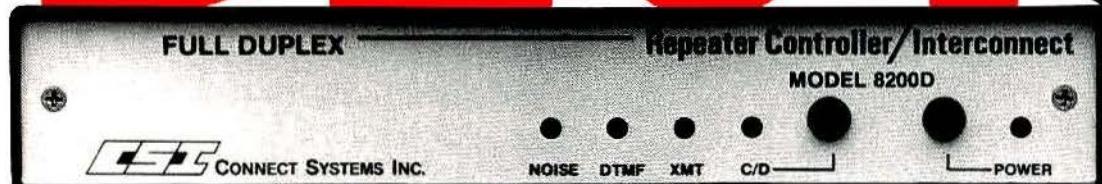
**David Clark COMPANY
INCORPORATED**

360 Franklin Street, P.O. Box 15054, Worcester, MA 01615-0054
TEL: (508) 756-6216; FAX: (508) 753-5827; TELEX: 920482

©1990 David Clark Company

Circle (16) on Fast Fact Card

BEST



MORE FEATURES AT
LOWER COST . . .

- Built-in programming keyboard and digital display assure trouble free set-up. No computer or computer knowledge required.
- 90 Number Speed Dialer
- Last Number Redial
- Hookflash
- User programmable CW Identifier
- Automatic busy signal/dialtone disconnect
- Ringout: sounds like a telephone
- Regenerated DTMF or pulse dialing
- COS Input: allows Carrier, CTCSS or DPL operation
- Resettable call limit and activity timers
- Line in use detection/call waiting
- 1-800 toll override
- Toll restrict
- DTMF signaling AND MORE

MODEL 8200: Full or Half Duplex Interconnect, Repeater Maker, Remote Base, Paging, and Selective Calling.

MODEL 9800: Vox Control Station (EVD optional) or Half Duplex Interconnect, Repeater Maker, Remote Base, Paging, and Selective Calling.

Land to mobile and mobile to mobile signaling options (both models):

- 2 tone 1000 call
- 5/6 tone 1000 call
- CTCSS 38 call



Connect Systems, Inc.

2064 Eastman Ave., Suite 113, Ventura, CA 93003

Turn your two-way system into a phone system today! CALL 1-800-545-1349 • FAX (805) 642-7271

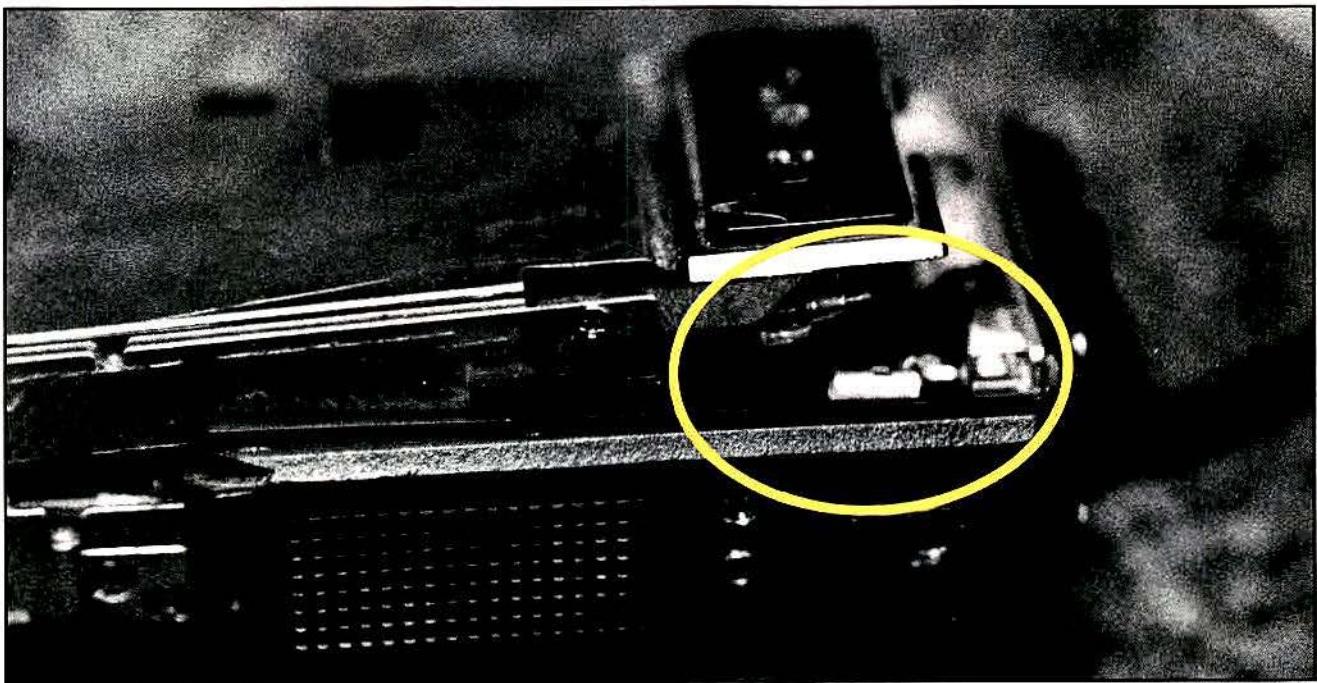
Circle (17) on Fast Fact Card

IN CANADA:
CARTEL (800) 663-0070
EASTCOM (416) 850-2550

INTERNATIONAL:
JESCOM (415) 574-1421

Phone
Patches
In The
Business
!





Further disassembly reveals an RF plug and socket are disconnected for an uncertain reason that might involve a faulty prior assembly, physical shocks delivered to the radio or a combination. The side panel containing the PTT switch cover is found to have damage that interferes with PTT operation, too.

Our new broadband panel of experts.

They're experts at versatility. Experts at reducing interference. They cover such a wide range, it takes fewer of them to accomplish just as much.

Perfect for any application: SMR, Cellular, Paging, even PCN, Celwave's new broadband line of panel antennas are available in 60°, 80°, 90°, 105° and 120° sector versions. Their profiles are slim, they're aesthetically pleasing, strip line fed, have no soldered joints and are made of iridited aluminum. Radiating elements

and feed point are protected from the weather by an environment-proof, ABS Radome.

When it comes to improving your system's performance, don't trust anyone but a Celwave expert.

CELWAVE 
DIVISION OF RADIO FREQUENCY SYSTEMS
Celwave, Route 79, Marlboro, NJ 07746
(908) 462-1880 (800) 321-4700

for service. Firefighters cannot give much attention to keeping their radios dry when they are busy extinguishing a fire. If the radio is wet, dry it before servicing it.

The radio can be opened while it dries. You may want to remove wet spots that otherwise could result in deposit buildup as the radio dries.

Measurements

An RF voltmeter can be used to measure signal levels at various test points. For example, with the transmitter activated, measurements can be made beginning with the transmitter's oscillator stage and at subsequent stages. If the manual does not mention voltages that should be present at each stage, measure a working radio first and note the signal levels on the schematic.

In the receiver section, inject an audio signal of proper strength and frequency into the last audio stage. As you listen to the output on the radio's speaker, move the injection probe from one stage to the next toward the receiver



Connecting the portable to a computer, Adams uses software to check the radio's transmit, receive and tone squelch frequency programming.

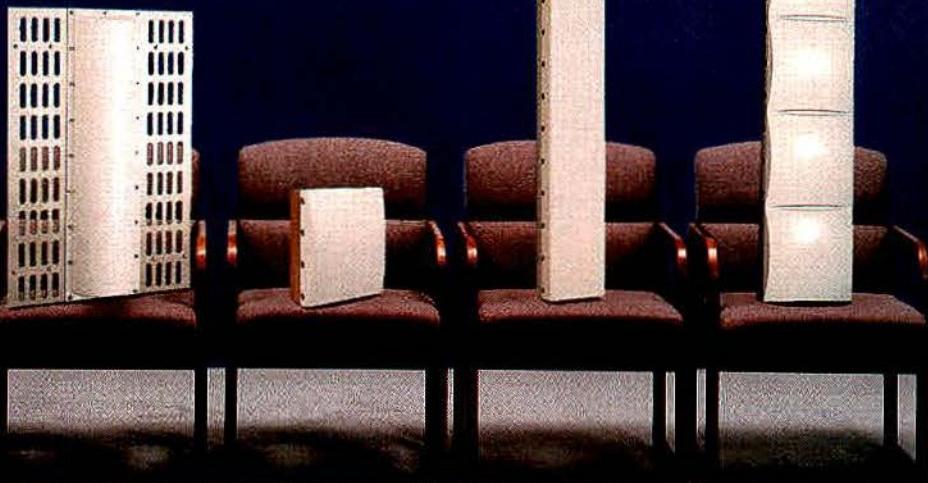
front end, injecting a signal of the correct strength and frequency for each stage. The injection signal may be obtained from your service monitor oscillator. Record on the schematic the sig-

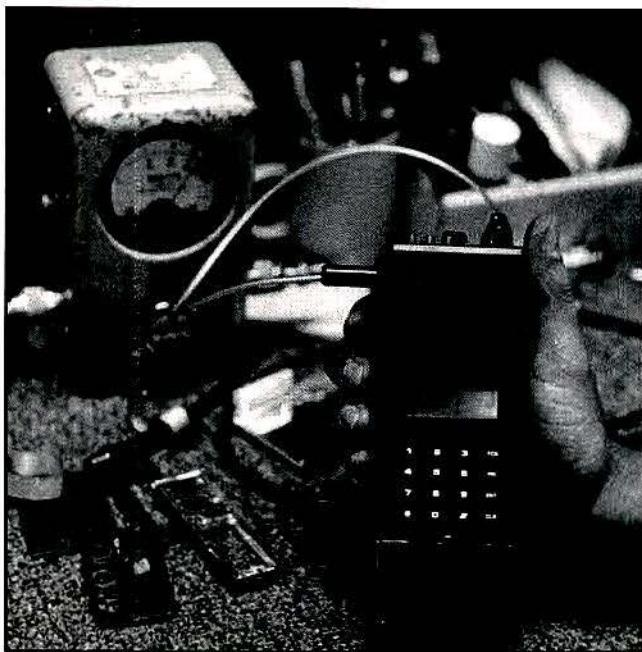
nal levels each stage needs to provide as an output.

When the problem has been isolated, the challenge is to replace the defective component on the fragile circuit board.

CELWAVE

DIVISION OF RADIO FREQUENCY SYSTEMS

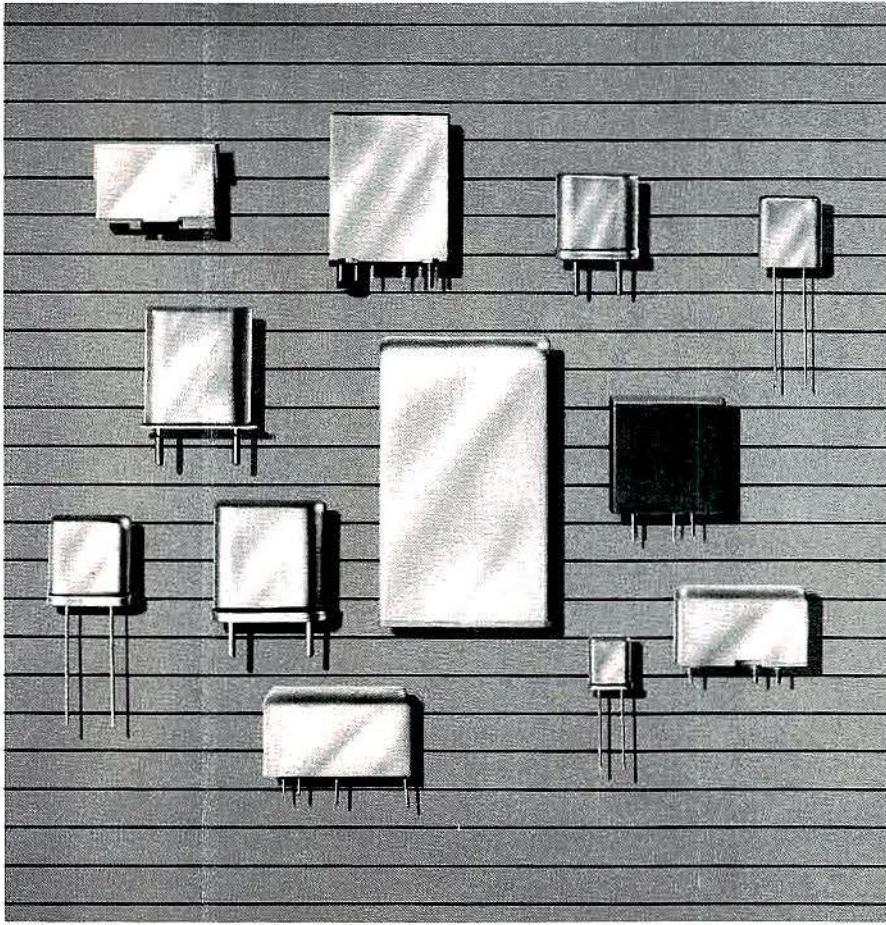




With the case replaced, the portable looks new. The wattmeter at the left measures transmitter output, which Adams adjusted to specifications. Frequency, sensitivity and signal purity measurements complete performance tests.



Because the electronic fault was a simple loose connection, almost 80% of the repair time is consumed by replacing all the panels that make up the portable's case. Some desoldering and resoldering is required.



Need crystals or TCXO's **FAST?**

**Use our 4-day
Expedite Service
on TCXO's...even
faster on crystals!**



International Crystal Mfg. Co., Inc.
P.O. Box 26330 • 729 W. Sheridan
Oklahoma City, OK 73126-0330
(405) 236-3741 • FAX (405) 235-1904
Toll Free 1-800 426-9825
24 Hour Toll Free Fax 1-800 322-9426

To remove it, use a small pencil soldering iron or desoldering tool. Solder wick may work satisfactorily if you are careful. For surface-mount devices, special tools may be required.

Use caution and a small soldering iron to solder the new component into place. Some manufacturers supply solder with a percentage of silver in the alloy. Silver solder flows at a lower temperature than the more common lead-tin solder, so it may give better results when you work on portable radios.

Performance tests

Once the repair is complete, inspect the portable to see that it is in working order. Inspect the seals to make sure the radio is as watertight as possible.

Measure the RF power output at each power level and retune the transmitter as necessary to meet specifications.

Make measurements using a service monitor and wattmeter. Measure each transmit frequency to verify frequency and modulation tolerances, resetting them as necessary. Measure each frequency's tone squelch signal and adjust its frequency and deviation as necessary.

Measure the RF power output at each power level and retune the transmitter as necessary to meet specifications. If a spectrum analyzer is available, use it to check the signal purity and to see whether the unit has any spurious emissions that exceed specifications.

Check receiver sensitivity on each frequency. Check the squelch control and the function of each channel's tone

maxon

Don't "BLOCK OUT" opportunity when you have a

CHOICE...

Maxon Telemetry/Data Radio Modules offer you complete versatility with your CHOICE of:

- VHF/UHF,
- 2 to 5 watts TX power,
- Transceivers
- (DM models),
- TX-only
- (DT models),
- RX-only
- (DR models).

When your requirements are:

- Fast attack times,
- Dependability,
- Compact size,
- Economical price –

MAXON IS YOUR CHOICE!

From irrigation equipment control to local area networks (L.A.N.'s), MAXON Telemetry/Data Radio Modules mean CHOICE!

For more information on MAXON Data Products, contact your nearest Authorized MAXON Dealer, or call us at 816/891-6320.

• GAS LINE MONITORING •

• STATUS MONITORING •

• IRRIGATION EQUIP. CONTROL •

• LOCAL AREA NETWORKS •

• DATA COLLECTION •

• COM

• WELL

• GRAIN BI

• SEWAG

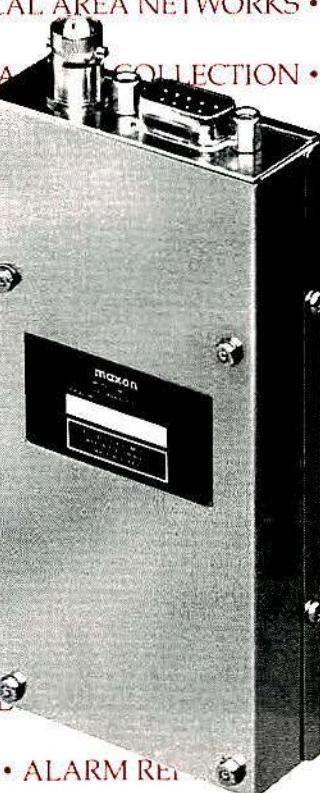
• HAZARD

• FARM

• SPRINKL

• FIRE

• BAR COD



• ALARM RE

• EMERGENCY SIGNALLING •

• STREET LIGHT CONTROL •

• METERING OR SCADA •

maxon[®]

ELECTRONICS

10828 NW Air World Drive
Kansas City, MO 64153
816/891-6320
FAX: 816/891-8815
© 1991 Maxon Electronics
North America, Inc.

squelch function.

Clean the radio before returning it to the customer. If part of the case is cracked or broken, replace it.

Operator tips

Some portable radios are brought to the shop because an operator has complained but they actually work fine. The operator may have used it improperly or

in an area where the system lacks sufficient coverage for portables to work. Portables may have only one-tenth of the power of a mobile, so they may not work in some areas where mobiles do. Most portables have RF outputs of about 2W to 4W.

Similarly, portable antennas usually are not as efficient as mobile antennas. For example, most mobile antennas are

a quarter-wavelength long or longer. They usually are mounted on a metal vehicle body that offers an effective ground plane. Moreover, mobile antennas usually are mounted vertically, giving them a polarization that matches the vertically mounted base station antenna.

On the other hand, performance of the flexible, loaded (rubber duck) antenna used with most portables usually is compromised because the antenna normally is shorter than a quarterwave, it has a poor ground plane and it often is used with the antenna in positions other than vertical. As a result, the portable radio is less effective compared to a mobile—less than the power difference alone might suggest. A 4W portable might be no more effective than a 1W mobile.

Compounding the problem is that portables often are used in locations less favorable for communications than mobiles, such as inside buildings. As much as 90% of the signal may be absorbed as it passes through the building's walls.

Some of the portable radio's limitations can be overcome by using a satellite receiver system and a receiver voter. Satellite receivers are placed throughout the operating area and linked to the base station by telephone or radio links. A receiver voter selects the best received signal among the satellite receivers and feeds it to the repeater.

A well-designed satellite receiver system with a number of receivers scattered across a metropolitan area usually will result in at least one receiver picking up the signal, even from an operator who is deep inside a large building. This result is of enormous benefit to police officers and others who rely on two-way radios for communications and safety during their work.

Still, a portable radio may not deliver as good of a performance as a mobile radio. The repair technician has to keep this in mind when a radio in perfect working condition is brought in with a performance complaint. The problem may be due to inherent performance limitations.

Repair challenge

Portable radio repair is a special challenge because of the radios' small size and fragility. A technician who learns how to fix portable radios well is an asset to any radio repair shop.



Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain Comp. (dB)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET \$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET \$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET \$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET \$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET \$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar \$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar \$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET \$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET \$119.95

Inline (rf switched)

SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET \$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET \$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET \$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET \$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET \$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar \$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar \$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET \$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8970A/HP348A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 6-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

**Advanced
Receiver
Research**

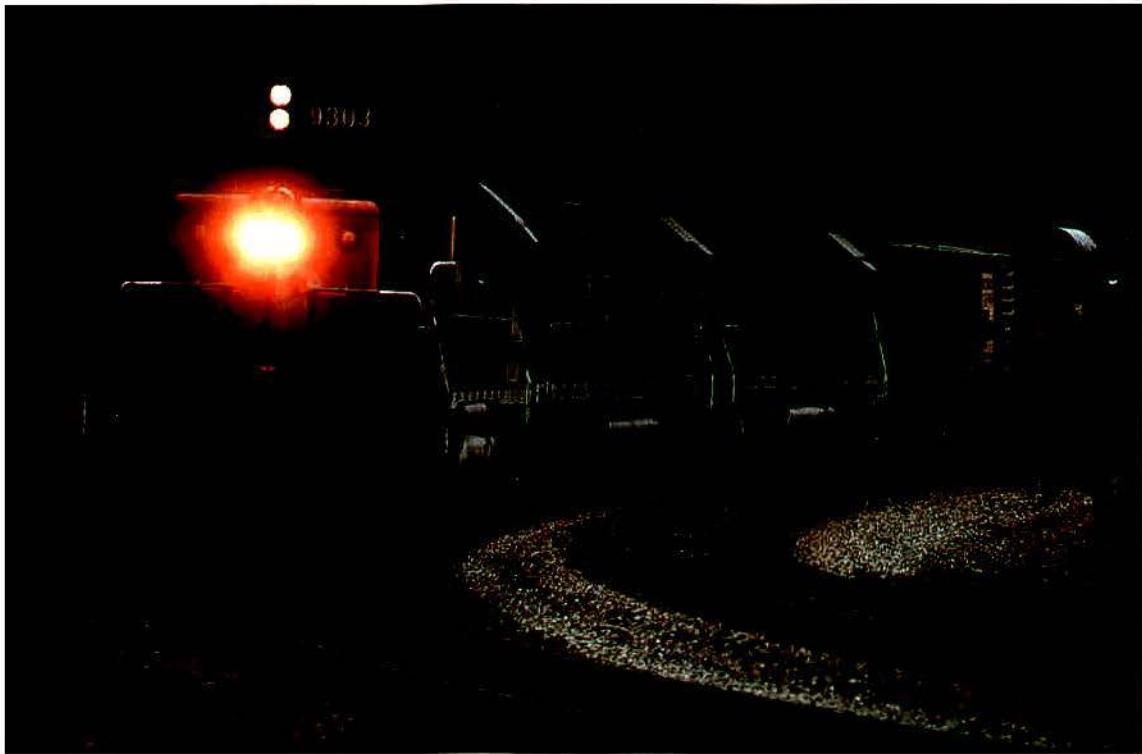
Box 1242 • Burlington, CT 06013 • 203 582-9409



Circle (20) on Fast Fact Card

Genius Streak

Are you going to buy a radio paging terminal this year?



The add-on concept works best in paging too.

We know a good idea when we see one. Add more cars to increase a freight train's load ... add more chassis to expand the capacity of a paging system.

With Unipage, you simply can't outgrow your system. Why? Because we designed our equipment around a modular X-bus chassis. Which means you can start off big or small and simply add chassis as your subscriber base and services grow.

Once you fill a system frame (up to 60 trunks), keep right on expanding. Just install another frame with more chassis to create a Unipage Tandem System. Capacity depends only on the number of card slots available.

With Unipage there's no need to buy more terminal than you require today. No need to sell your existing system and buy a larger one to carry the load. And no need to discard power supplies, cabinets or any other equipment. Instead, you can build smoothly on your original investment ... right up to supporting more than 2 million subscribers with:

- 1920 trunks
- 120 voice recorders
- 128 channels or network ports
- 256 modem ports

It's easy to upgrade Unipage systems too. All models can share spares and exchange cards for reconfigurations.

Unipage is the only major manufacturer today 100% committed to paging technology. Our current customers range from small-area PCPs to large nationwide RCCs and RBOCs. *Four of the five nationwide paging companies use our systems and networking technology today.*

Give us a call and let's talk over your paging business. Unipage design is right on track with your growth.



unipageTM

1509 Falcon
DeSoto, Texas 75115
(214) 224-3509
1-800-367-2864
FAX (214) 228-1430

Subcarrier communication for public safety dispatching

With careful project design, funds made available to consolidate county radio dispatch services with 'Dial 9-1-1' emergency services may include subcarrier communications to reach all agencies within the county.

By James M. Crooks

Many states have authorized limited funding for "Dial 9-1-1" emergency telephone and radio dispatch services at the county government level. Funding methods differ from state to state. Nevertheless, the availability of funds has a renewed interest in 9-1-1 service. Sometimes county governments find it possible to use 9-1-1 construction projects in part to consolidate public safety telephone and radio communications within the county.

Such consolidation often changes the method of handling emergency calls. Either the county sheriff's office or another responsible agency must take a leading role. That role is to handle the communications and ensure that calls are directed to the right public safety agency for a swift response.

A popular communication method is to page each rural fire department and emergency medical service agency in the county. Many county governments do not have a countywide paging system, and the cost of expanding an existing local-coverage system may be quite high.

Subcarrier solution

Where at least one FM broadcast station covers the entire county, subcarrier paging offers a solution. An FM station licensee has the option to broadcast additional services beyond the program-

Subcarrier considerations

Important points for a public safety agency to consider before relying on an FM broadcast subcarrier for emergency communications include:

- Does the FM station broadcast 24 hours?**
- Does the station have an auxiliary transmitter for use if the main transmitter fails?**
- If the station has a periodic transmitter maintenance interval, does it go off the air during the interval or does it use an auxiliary transmitter to keep broadcasting?**
- Is the station equipped with a standby power source, such as a generator?**

Subcarrier advantages

Most public safety agencies must have 24-hour access to paging and to an alternative method of alerting its employees when the principal method of paging fails.

Some of the advantages of an FM broadcast subcarrier for the principal method of paging include:

- Most FM broadcast stations have countywide coverage, which may be difficult to achieve inexpensively with a stand-alone system.**
- The paging system uses the FM station's transmitter, feedline and antenna, so there is no need to purchase them separately.**
- To place paging messages on the FM signal, only a subcarrier generator is required. Most subcarrier generators cost less than \$2,000.**

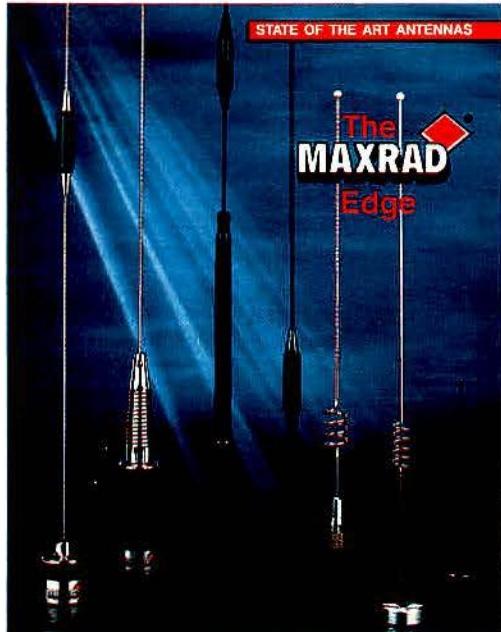
ming intended for public reception. The FCC grants permission under terms of a "subsidiary carrier authorization." "Subcarrier" is a contraction of *subsidiary carrier*.

The number of subcarriers available on a given station depends upon the method used for modulating the subcarriers and the bandwidth required by the

information they carry. Many FM stations make one or two subcarriers available; some offer as many as five.

Services offered via subcarrier include background music, text transmission, remote control and radiopaging. Radiopaging is the application that may be attractive in supporting 9-1-1 emergency services.

Crooks is president of Broadcast Communications, Verona, WI. He is a former chairman of the Wisconsin State 9-1-1 Board.



MAXRAD ANTENNAS...

A WORK OF ART
WITHIN THEMSELVES!

Maxrad builds a picture of quality and durability that carries throughout our long line of land mobile, 2-way cellular and data telemetry antennas for mobile, base station, and portable radio applications.

From our chrome loading coils with stainless steel rods to our rugged and dependable Yagis.

Maxrad paints a complete picture which includes...

◆ QUALITY ◆ FAST DELIVERY ◆ COMPETITIVE PRICING

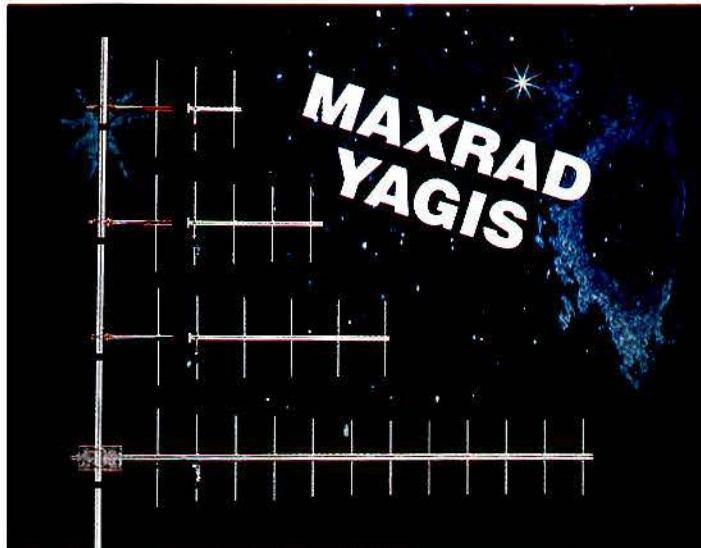
MAXRAD QUALITY... HAS NO LIMITS!

- ◆ Stainless steel hardware
- ◆ Elements are 3/8" solid bar mounted through boom for rugged construction
- ◆ VHF, UHF, 800 & 900 MHz
- ◆ All stainless steel hardware
- ◆ Factory assembled & tuned
- ◆ All models UPS shippable

Maxrad VHF, UHF, 800 & 900 MHz Yagis are constructed of rugged 6061-T6 aluminum and are built according to the proven designs of NATIONAL BUREAU OF STANDARDS 688 technical note. The 3/8 inch elements are bolted through each boom with stainless steel hardware for positive RF connections.

All models except VHF are factory assembled and tuned to mid-band for ease of installation. Maxrad VHF Yagis are field tunable or, on request, can be tuned to your specific transmit frequency. Our heavy duty models are constructed with double wall booms throughout.

For superior corrosion resistance, low visibility and ice melting characteristics, Maxrad UHF, 800 & 900 MHz are now offered in MAX BLACK. All Yagis are available with SO-239 or N female connectors.



MAXRAD®
State of the Art Antennas

2495 PAN AM BLVD. • ELK GROVE, IL 60007
1-800-323-9122 • (708) 595-3933 • FAX (708) 595-3951 • TECH (708) 595-3934

Some public safety dispatch center managers arrange for the audio from the dispatch console to be fed via phone line to the subcarrier modulator at the broadcast station. Whatever goes out over the two-way radio dispatch frequency simultaneously is broadcast over the subcarrier.

Receivers

Many types of subcarrier receivers can be used to fit the requirements of the various agencies and their employees or volunteers who are tuned to the subcarrier.

For example, a volunteer fire department might use pagers on the subcarrier frequency. A dispatcher who sends the fire department's paging code would activate the volunteers' pagers to alert them to an emergency.

A subcarrier receiver could be connected with a remote base station transmitter to rebroadcast certain messages under the control of the dispatcher.

Subcarrier receiver audio can be used to feed telephone lines.

When combined with various types of signaling, the use of the subcarrier offers the dispatcher access to various remote control, paging and group call capabilities.

Aside from sending a voice message, the dispatcher could send a computer-

provide hard copy for use by fire department and emergency medical service employees upon their arrival.

The subcarrier with a CAD system could be used to feed computer information to other local government and public safety agencies in the county. The cost normally does not exceed \$1,500 for a subcarrier receiver, modem and printer for each location.

An FM broadcast subcarrier is a one-way communication system.

aided dispatch (CAD) package that contains a phone number, address and other information into a modem that would broadcast the information burst over the subcarrier. A modem connected to a subcarrier receiver would allow a printer to recover all the information and to

One-way communication

An FM broadcast subcarrier is a one-way communication system; there is no way to use the subcarrier to return communication to the sender.

It would be possible to place a radio receiver at the FM station to pick up responses on another frequency and feed them to a second subcarrier. But that is a rather cumbersome arrangement that could raise the cost beyond an economical level.

Figure 1 on page 30 shows a block diagram of how a subcarrier system has been put to work for a public safety agency.

U.S. Pat.
#4,249,147

Can. Pat.
#1,133,598

EXPANDABLE T-PASS® MULTICOUPERS

TX RX has them — In ranges from 132 to 960 MHz.

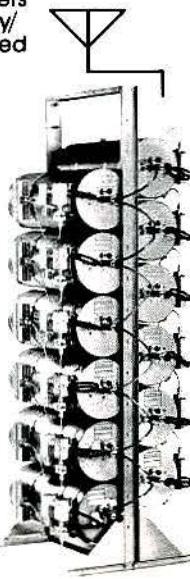
High performance receiver multicoplers with window preselectors. Unique cavity/ferrite transmitter multicoplers designed for ease of expandability, channel rearrangement and field tuning. A single antenna system, 400-512 MHz, is available with model #73-67-01-12, accepting 250 watts at 300 kHz spacing. A portable meter allows tuning individual channels without air time interruption.

PRESELECTOR

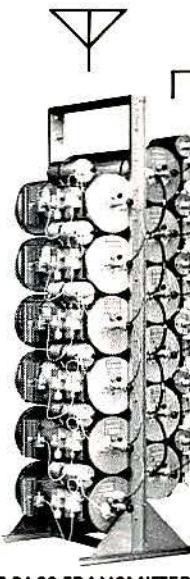
BIPOLAR RECEIVER MULTICOUPLER
#42-67-22



T-PASS TRANSMITTER EXPANSION CHANNEL
#21-67-25-DF60T



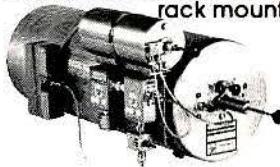
T-PASS TRANSMITTER MULTICOUPLER
#73-67-01-12



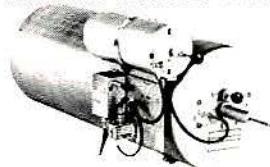
T-PASS TRANSMITTER/
RECEIVER
MULTICOUPLER
#74-67-(custom)

T-PASS expandability can make "custom designs" a straightforward process. We provide highly selective transmit and receive channels for sites with limited transmit-to-receive antenna space isolation, while maintaining orderly, predictable expansion characteristics.

The UHF multicoupler (left) shows the flexibility of our patented T-PASS rack mounting.



T-PASS TRANSMITTER EXPANSION CHANNEL #21-67-25-4V-DF60T



T-PASS RECEIVER EXPANSION CHANNEL #21-67-25-4V-A12



Duplexers Cavity Filters Repeater Amplifier Systems RF System Products Hardware
TX RX SYSTEMS, INC.

8625 Industrial Parkway, Angola, NY 14006, (716) 549-4700 • Telex 755770 • 24-hr Fax (716) 549-4772

Circle (23) on Fast Fact Card

Visit us at APCO, Booths 1232 & 1234.

When time means everything.

Every day firefighters, police, and other emergency personnel put themselves on the line to save others. Clear and immediate communication is often the key to their performance and safety. Kyodo West knows that.

We offer quality communications products and complete systems packages. Communications that can make the ultimate difference in a life and death situation.



Kyodo West - when communication really counts.

► **KG109 Portable Transceiver**

For more information on our KG109 portables or any of our full line of products, see your local dealer. Or call us direct at: 1-800-535-2082.

Circle (24) on Fast Fact Card



kyodo west™

Kyodo means cooperation.

Kyodo West, Inc. • P.O. Box 112728 • Pittsburgh, PA 15241 USA • (412) 281-7895 • (800) 535-2082 • FAX: (412) 221-9518

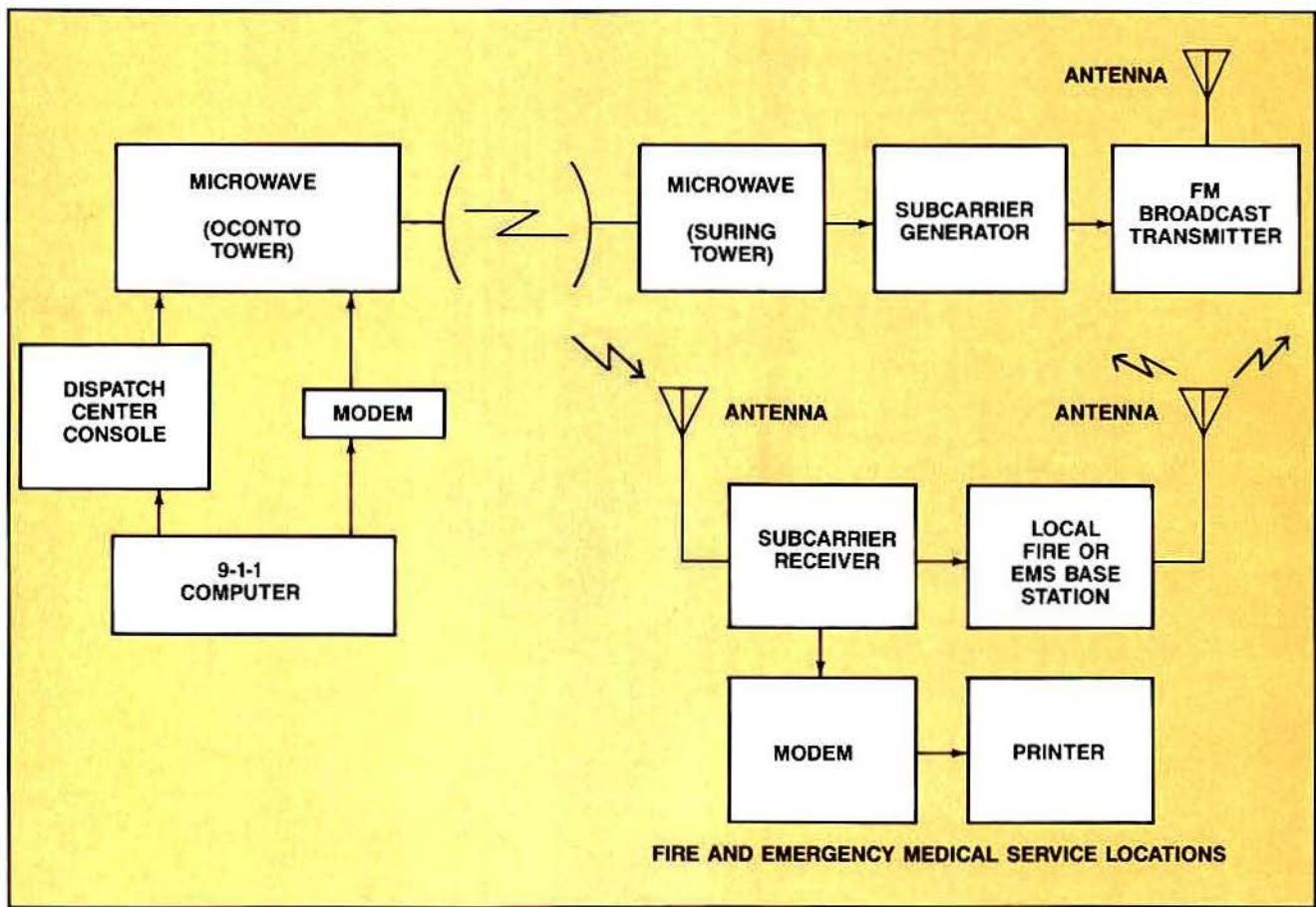


Figure 1. At Oconto County, WI, dispatch center employees designed a subcarrier paging system to communicate with fire department and emergency medical service locations throughout the county. This block diagram shows the key elements of the transmitting and receiving systems.

Here are some of the steps usually taken in establishing a subcarrier communications system:

(1) Inquire at the FM broadcast stations in the area to learn the limits of their coverage areas and whether they are prepared to make a subcarrier available.

Ask at each station whether the station has backup emergency power and an auxiliary transmitter.

Find out whether the stations schedule any periods during which neither the main or auxiliary transmitter is on the air.

(2) Ascertain the fees suitable stations

would charge for the use of a subcarrier. A subcarrier subscription fee usually is \$200 per month or more.

The cost of the subscription ordinarily compares favorably to what otherwise must be spent for land; a shelter; a tower; a transmitter; an antenna; and a feedline to build a stand-alone com-

YOUR ONE STOP FOR ALL YOUR GROUNDING NEEDS

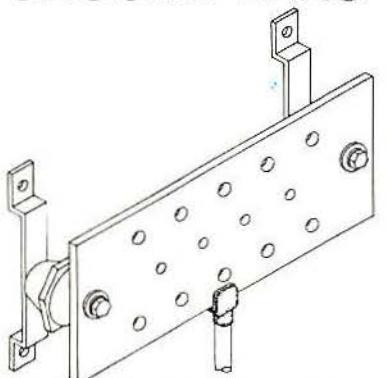
- TRANSIENT VOLTAGE SURGE SUPPRESSORS •
- GROUNDING WIRE • GROUND RODS •
- GROUNDING STRAPS •



HARGER
LIGHTNING PROTECTION, INC.

1066 CAMPUS DRIVE MUNDELEIN, IL 60060
(708) 362-4848 (800) 842-7437 FAX (708) 362-3519

GROUND BARS



DISTRIBUTORS OF: CADWELD® POLYPHASER

Circle (25) on Fast Fact Card

Selected as a Top-Ten
New Product for IMCE '91

Now Half Is Enough. And That's the Long and the Short of It.

Yesterday, you needed to stock six antennas to effectively cover the UHF and VHF portable radio bands.

But that was then.

Today, half will do it. Thanks to Centurion's exclusive broadbanding network design (patent pending), you need to stock only one antenna for UHF, and just two for VHF.

This technological breakthrough is good news for you because it simplifies your inventory problems. And because you still can



136-162 / 148-174 MHz 400-512 MHz

be assured that you are providing Centurion performance to your customers.

That's good news for your customers, as well. Because Centurion's molded antennas are built tough to handle rugged use. And because we test and 100 percent tune every antenna before we ship.

Take advantage of this Centurion breakthrough in broadbanding technology. Call us toll-free at 800-228-4563 for the name of our nearest distributor.



P.O. Box 82846, Lincoln, Nebraska 68501
Toll-Free Fax: 800-848-DUCK (3825)

SCA generators and receivers

This list includes manufacturers of SCA (subcarrier) generators, receivers or both. To receive information from a specific company, circle the number indicated on the Fast Fact Card bound into this issue.

CRL Systems

Circle (500) on Fast Fact Card

Dayton Industrial Corp.

Circle (501) on Fast Fact Card

FM Systems Inc.

Circle (502) on Fast Fact Card

Marti Electronics

Circle (503) on Fast Fact Card

McMartin Industries

Circle (504) on Fast Fact Card

Micro Controls Inc.

Circle (505) on Fast Fact Card

Moseley Associates Inc.

Circle (506) on Fast Fact Card

Reach Electronics

Circle (507) on Fast Fact Card

SCA Data Systems Inc.

Circle (508) on Fast Fact Card

SMC International

Circle (509) on Fast Fact Card

munications facility.

(3) Survey the public safety agencies that would be served by the countywide communications system. Be sure to include the rural fire departments and emergency medical services. Explain the advantages and cost reductions, and find out whether they would be willing to use a shared countywide system.

(4) Muster the necessary support for the project. Keep in mind that the heads of each agency and the public officials who make decisions about spending money each may have somewhat different objectives. The use of a consultant to help with drafting the survey questions and the project proposal may help to prevent local rivalries from derailing a worthwhile project.

(5) Select and purchase a subcarrier generator for installation at the broadcast station. (A list of subcarrier equipment vendors appears on the left.) As an alternative, you may want the station to provide the subcarrier generator. Some stations are willing to do so and to amortize their expense by charging

PROVEN PERFORMERS - ECONOMY PRICED

Rural Telephone System

Provides Wireless Phone Service



Low-cost alternative to wireline service.

Provides full-duplex remote telephone service compatible with DTMF or rotary exchanges. The remote terminal provides ring voltage to activate any standard telephone set bell. Plugs into virtually any repeater system.

Model RTS-25 \$499.00

Automatic Morse Code Identifier and Site Monitor

Microcomputer-controlled and totally field programmable, including the ID and all timing parameters. Provides inhibit inputs and an inhibit-release delay to prevent traffic interference. Meets all FCC requirements. The site monitor feature enables up to six site functions to be continuously monitored and to provide status information to a remote decoder.

Model ID/SM-700 \$159.00

DATA SIGNAL INCORPORATED

2403 Commerce Lane Telephone: 912-883-4703
Albany, Georgia 31708 Toll Free: 800-652-9296

Circle (27) on Fast Fact Card



RPM Mobile Radio

10 Channels

MIL-STD Spec 810 C&D Certified

Multiple-Coded Squelch Capability

Scan—Priority Or Normal

Time-Out Timer

VHF Transmit Power: 30 Watts

UHF Transmit Power: 25 Watts

VHF Frequency Separation: 15 MHz

UHF Frequency Separation: 20 MHz

Synthesized, Field Programmable

\$469 VHF

\$499 UHF



M208 Mobile Radio

8 Channels

MIL-STD Spec 810 C&D Certified

Multiple-Coded Squelch Capability

Scan—Not Available On This Model

Time-Out Timer

VHF Transmit Power: 25 Watts

UHF Transmit Power: 25 Watts

VHF Frequency Separation: 12 MHz

UHF Frequency Separation: 10 MHz

Synthesized, Field Programmable

\$610 VHF

\$700 UHF

IT'S EASY TO SEE WHICH MOBILE RADIO COMES OUT ON TOP. JUST CHECK THE BOTTOM LINE.

Our RPM Series mobile radio stacks up to the competition. But the price is what really makes the difference. We based this radio on a simple marketing strategy: We give you a high-quality product with lots of features. And charge less for it.

RPM radios are fully-programmable 2-way mobile radios. They're created using modern design and manufacturing technology, to give you an outstanding combination of features and reliability. Add that to our remarkably low price and one year warranty, and you've got what we consider the best value on the market.

We'd like to go on and on about all the other features, but then we'd have to buy a 2-page ad. And then we'd have to charge more for our radios. Our ad agency thinks it's a great idea. But we'd rather give you a better price.

You see, we designed our RPM mobile radios with value in mind. So, if you want a high-quality radio with lots of features, but you don't want to pay lots of dollars, check out our RPM Series mobile radios. Or contact us for additional information: 1-800-USA-1-USA. In Indiana, call: (317) 846-1201. FAX: (317) 846-4978.

RITRON
RPM MOBILE RADIO



MADE IN
THE U.S.A.

Prices based on latest available manufacturers' suggested retail price as of 6-21-91. Basic features listed for comparison only. List is not exhaustive.

Comparison is between the Ritron RPM 10 channel mobile radio (VHF and UHF) and the Motorola M33LRC00D2-A (VHF) and M34LRC00D2-A (UHF).

Circle (28) on Fast Fact Card

a higher monthly subcarrier subscription fee.

Generally, the station engineer will want to take the responsibility for installing and maintaining the subcarrier generator because of its potential to affect the main broadcast signal.

(6) Select and purchase subcarrier receivers.

Subcarrier pagers may be used to allow rural fire department and emergency medical service employees and volunteers to be alerted directly. Alternatively, a subcarrier receiver at a given agency's dispatch point can be connected to activate its existing radio communications facility to broadcast a message received via the subcarrier.

Practical tips

• *Field test*—Broadcast station managers usually cooperate well with public safety agencies, including the county sheriff. In many cases, the sheriff's department coordinates any countywide radio and telephone communications projects, contracts the work and assumes responsibility for operating the communications facilities.

When approached by the sheriff's department as a potential customer, the station manager may be willing to test the subcarrier coverage as it will be used by the county.

Ask a prospective vendor to lend a subcarrier generator and one or more receivers for a test period. Ask the station manager to have the generator installed for the tests. Then you can take

the receivers anywhere in the county you want and test the coverage. Actual field testing does wonders for dispelling any doubts that individual agency heads may have as to the effectiveness of the proposed system.

• *Extra features*—The subcarrier communications system can be used to provide rural fire departments with information they may never have had before, such as printed maps and directions from the dispatcher.

In parts of the country with enhanced 9-1-1 service and computer-aided dispatching, the subcarrier may be used to carry data communications to a printer at the fire department. The enhanced 9-1-1 service and the video display at the computer-aided dispatch position may show a map of the area where the emergency call originated; directions to get there; a listing of hazardous materials at the site and a history of previous emergency responses to the same location.

The dispatcher can send the information over the subcarrier. At the fire department, an inexpensive modem and computer printer are all that is needed to reproduce the information in written form for the firefighters. This option offers a simple way for a rural fire department to upgrade its response preparation. It documents the call and may reduce certain liabilities.

Similar capability can be installed by using leased telephone lines. But leased line rates in some areas have increased by 400% in the last five years, and they

are likely to increase more. The low cost of the subcarrier makes emergency data communications more practical.

• *Negotiations*—It may be possible to negotiate a lower subcarrier subscription fee with the radio station in exchange for equipment and services.

For example, if the station has no emergency power, the county government could offer to buy the station a generator in exchange for free use of the subcarrier for the first several years. The station can use the generator whenever it is necessary.

When the station's subcarrier becomes part of the county's communications system, the sheriff's department has a vested interest in the station's security. The prospect of additional attention from sheriff's patrols may be appealing to a station manager, especially if the studio and transmitter are in an isolated area.

The county highway department may be enlisted to keep the station driveway clear so technicians have access to the communications equipment.

Establishing a subcarrier communications system makes it possible to upgrade emergency dispatching services in many counties where it would be impractical to build a stand-alone countywide radio communications facility.

Careful planning, interagency cooperation and the right broadcast station subcarrier installation allow a countywide communications system to deliver upgraded, economical service.



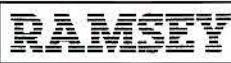
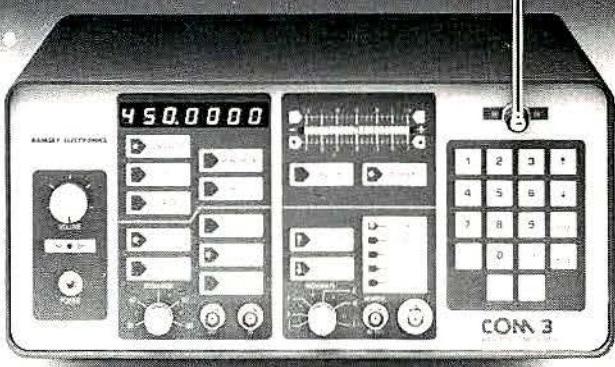
COM-3 SERVICE MONITOR

When you see your techs standing in line waiting for the service monitor, you know your profit line is parked... and in idle. Now, with the remarkable low cost of the new Ramsey COM-3, you can have a service monitor on every bench. COM-3 can turn wasted idle time into new found "profit" time. In addition, COM-3 will easily turn a profit in the field. Engineered as a

At \$2795, you can put one on every bench.

rugged, full featured portable, the rechargeable COM-3 will take your services where others can't. And, with its advanced microprocessor circuitry, COM-3 speeds your techs' testing capabilities, keeping your profit line moving... in full gear.

COM-3. The new service monitor that works harder for less.



RAMSEY ELECTRONICS

793 CANNING PARKWAY, VICTOR, NY 14564
FAX: (716) 924-4555
TELEX: 466735 RAMSEY CI



ORDER DIRECT—CALL 716-924-4560

Quality crafted in the USA



Circle (29) on Fast Fact Card

Symptoms:

Johnson Trunking*
DCS*
POCSAG
Golay
DTMF
GE Mark 5
NEC
Single Tone
2 Tone
5 Tone
IMTS
MTS
2805 pulse
2+2
ZVEI
CCIR
HSC

* Decodes and Encodes

Rx:

CT SYSTEMS
Model 300
Universal Service Encoder
Use daily as needed!

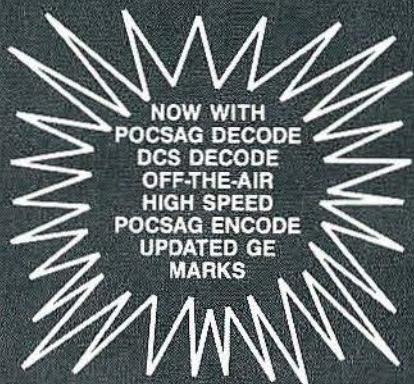


At Last! A Cure For The Uncommon Code!



The CT Systems Model 300 is truly a Universal Service Encoder. Even trunking formats are included. Analog and Digital paging schemes are standard...as well as DTMF, DCS and Trunking Decode. The Model 300 is completely self-contained and ready to operate with internal battery, level control and high resolution LCD. Best of all, its flexible programming allows for future additions.

Johnson Trunking is a registered trademark of E. F. Johnson Co.



NOW WITH
POCSAG DECODE
DCS DECODE
OFF-THE-AIR
HIGH SPEED
POCSAG ENCODE
UPDATED GE
MARKS

With all of this going for it, the CT Systems Model 300 Universal Service Encoder is nothing to sneeze at. And, at only \$985, you won't have to cough up a lot of money.

CT SYSTEMS/WAVETEK
5808 CHURCHMAN BY-PASS
INDIANAPOLIS, IN 46203-6109
317-787-5721
1-800-245-6356
TELEX: 217124
FAX: 317-788-4197

MTD Fiberglass

Decibel's MTD™ Fiberglass Radome handles tough environments even though it's one-third the size and twice as pretty as the "monster."

Decibel's Minimum-Tip-Deflection™ Fiberglass radome antennas resist winds to 150 mph (241 km/hr) with 0.5 inches (12.7 mm) of icing. And they stand up straight with tip deflections of little more than 0.5°.

So if you need heavy duty antennas for UHF, cellular, paging, trunking or conventional radio, these monster slayers can save you. Look at the features: Very broad bandwidth. High gain. Optional pressurization and electrical downtilt on some models. Pleasing

Horizon Blue™ color. Superior lightning grounds. Drain plugs top and bottom. All are tested for intermodulation generators and power handling. And power inputs to 1000 watts! And now, new Mirage™ MTD fiberglass antennas with small 1.5 inch (38.1 mm) radomes offer many of the same features at lower prices.

Check the list and contact Marketing, Decibel Products, P.O. Box 569610, Dallas, TX 75356-9610. Telephone (214) 631-0310. FAX (214) 631-4706.

An Alliance Telecommunications Company



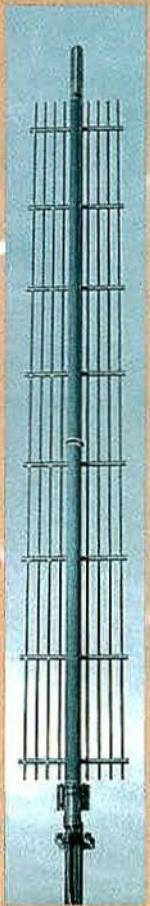
**Decibel designs systems
that communicate... quality!**

Directional panel antennas available.

Antenna (Omni)	Range-MHz	Gain-dBd	Input-watts	Features
DB630/3	406-512	0 or 3	600	Dual Skirt Dipole™ (DSD™)
DB636/8	406-512	6 or 8	600	DSD, up to 40 MHz bandwidth
DB580/3	806-960	0 or 3	400	Mirage 1.5" (38.1 mm) radome
DB586/9 (photo)	806-960	6 or 9	400	Mirage, 3° or 6° electrical downtilt optional
DB806/9	806-960	6 or 9	500	DSD, optional 3° or 6° electrical downtilt
DB806D/TL (photo)	806-960	6 each	500	Dual or triple DB806 antennas
DB803Q	806-960	3 each	500	Quad — air-to-ground radio telephone
DB812F (photo)	806-960	12	500	DSD, 0.5° electrical downtilt standard
DB812HF	806-960	12	1000	HP pressurized model inputs 1200 watts
DB859/60	806-960	9 or 10	550	Optional 3°, 6°, 10° electrical downtilt

In Canada contact ECD, Inc., Calgary, Alberta T1Y 5Z7; 8-3610 29th St. N.E. Phone 1-800-661-8579, FAX (403) 250-5349.

Visit us at APCO, Booth 529.



Aeroglas™

Radomes with only half the weight and wind loading of our Minimum-Tip-Deflection™ fiberglass. A Decibel exclusive!

Decibel offers base station antennas in Horizon Blue™ color with exclusive Aeroglas fiberglass radomes for VHF, UHF, cellular, paging, trunking and conventional radio. (See list below.)

Tests and experience prove that Aeroglas resists shock, vibration, winds to 125 mph (200 km/hr), extreme temperatures and saline and caustic environments.

Directional panel antennas available.

It has amazing strength, yet is very lightweight. That's why it's used for helicopter rotor blades, Olympic vaulters' poles and for racing sailboat masts.

All antennas are tested for intermodulation generators and power handling.

Contact Marketing, Decibel Products, P.O. Box 569610, Dallas, TX 75356-9610. Telephone (214) 631-0310. FAX (214) 631-4706.

An Alliance Telecommunications Company



**Decibel designs systems
that communicate . . . quality!**

Antenna (Omni)	Range-MHz	Gain-dBd	Input-watts	Features
DB506/16	138-174	5.5/2.5	500	Also for international marine
DB616 (photo)	140-174	5.3	500	Heavy Duty Dual Skirt Dipole™
DB536/8	380-512	5.5/7.5	400	Patented Center-Fed-Collinear™
DB540	380-512	10	400	Center-Fed Collinear beam control
DB640	406-512	10	600	Heavy Duty DSD™, 32 MHz bandwidth
DB553	806-960	3.5	550	Flanged or pressurized optional
DB557	806-960	7.5	550	3°, 6°, 10° electrical downtilt optional
DB559 (photo)	806-960	9	550	3°, 6°, 10° electrical downtilt optional
DB560	806-960	10	550	3°, 6°, 10° electrical downtilt optional

Directionals have solid-rod aluminum backscreens. *Models with optional 3°, 6° or 10° electrical downtilt.

DB561/2/3*	806-952	11/12/13	550	135°, 150° or 170° CFC™
DB563S10	824-894	10.5	550	135° Reduced length
DB564* (photo)	806-952	14	550	120°, Center-Fed-Collinear
DB564S12	824-894	12	330	120°, Broad bandwidth
DB567*	806-952	17	550	60°, Center-Fed-Collinear, high gain
DB567R90	806-894	10	550	190°, Reverse screen
DB567Y*	806-952	17	550	60° Dual, Center-Fed-Collinear

In Canada contact ECD, Inc., Calgary, Alberta T1Y 5Z7, 8-3610 29th St. N.E. Phone 1-800-661-8579, FAX (403) 250-5349.

Visit us at APCO, Booth 529.

Choosing the right modem for a mobile network

Part 1—Simple calculations can be used to estimate the required bit rate for mobile communications networks. The bit rate is one specification used to choose a modem to fit system requirements.

By Barry Dorr

Mobile data communications networks use a fundamental element—a modem—to link the data communications equipment to the radio frequency (RF) equipment.

Mobile data equipment purchasers may be confused by manufacturers' specifications for channel throughput, bit rate and modem performance. The following shows how to estimate the rate at which a mobile system must pass data (the data rate) to meet channel use estimates. Part 2 in this two-article series demonstrates the use of simple laboratory measurements to determine how well a modem performs and whether one modem out-performs another.

The required bit rate

To determine the bit rate required to serve a particular system, several factors must be considered.

► **Message length**—A convenient starting place is to determine the anticipated message length over the inbound channel (from the mobiles to the base.) Normally, the inbound channel is the important limitation because a large number of mobile units must compete for it.

Two types of users, a police department and an urban traffic control cen-

Modem: A device that converts data from one form into another, as from one usable in data processing to one usable in radio transmission. The word is a contraction of *modulator-demodulator*.

ter, offer contrasting examples:

A mid-sized city's police department uses laptop computers to send reports from 100 vehicles to headquarters, to check license plates, to check gun serial numbers and for other purposes.

A police officer may send five 2,200-character reports and 10 45-character requests for information during an eight-hour shift. For both messages, the character length is six bits. The required average throughput for the reports is 229 bits per second:

$$\begin{aligned} & \left(\frac{100 \text{ vehicles}}{} \right) \left(\frac{45 \text{ characters}}{\text{message}} \right) \\ & \left(\frac{6 \text{ bits}}{\text{character}} \right) \left(\frac{10 \text{ requests}}{8 \text{ hours}} \right) \\ & \left(\frac{1 \text{ hour}}{3,600 \text{ seconds}} \right) \\ & = \left(\frac{9.375 \text{ bits}}{\text{second}} \right) \end{aligned}$$

$$\begin{aligned} & \left(\frac{100 \text{ vehicles}}{} \right) \left(\frac{2,200 \text{ characters}}{\text{report}} \right) \\ & \left(\frac{6 \text{ bits}}{\text{character}} \right) \left(\frac{5 \text{ reports}}{8 \text{ hours}} \right) \\ & \left(\frac{1 \text{ hour}}{3,600 \text{ seconds}} \right) \\ & = \left(\frac{229.166 \text{ bits}}{\text{second}} \right) \end{aligned}$$

The average required throughput for both operations therefore is 238 bits per second:

$$\begin{aligned} & \left(\frac{229 \text{ bits}}{\text{second}} \right) + \left(\frac{9 \text{ bits}}{\text{second}} \right) \\ & = \left(\frac{238 \text{ bits}}{\text{second}} \right) \end{aligned}$$

The requests for information require an average of nine bits per second:

An urban traffic center uses Global Positioning Satellite (GPS) receivers to relay the positions of 200 roaming tow

Dorr is senior engineer at Coded Communications, Carlsbad, CA. He is a member of the design group that developed the company's IQmodem product. Examples in this article are based on that product.



STS consoles can be custom designed and built for your facility, at about the same prices you'd expect to pay for off-the-shelf furniture.

STS uses advanced fabrication techniques based on modular concepts, combined with master craftsmanship to bring you the best in equipment consoles at highly competitive prices.

Our consoles and racks feature welded tubular steel framework. Welds are carefully finished and the entire frame is protected with tough, baked-on epoxy coating, ensuring that

Modular Concept. Custom Design.

your furniture will keep its good looks through years of service. Choose from a wide range of top-quality laminates and hardwood trims. Color-coordinated countertops, correct ergonomics for your application, and the look of custom-built furniture all give your installation the professional appearance you deserve.

From single-bay consoles to elaborate control centers, STS offers you the greatest value in the industry. So, before you make any furniture decisions, come to STS. Call today for more information.



Skaggs Telecommunications Service, Inc.

5200 South Main, Murray, Utah 84107 • P.O. Box 27477, Salt Lake City, Utah 84127 • (801) 261-4400, Fax: (801) 261-1580

Circle (33) on Fast Fact Card

trucks to their dispatch center.

The traffic center requires position updates once every mile or once every two minutes for a slow-moving vehicle. This requirement converts to a bit rate as follows: The tow truck's average freeway speed is about 45 mph. The standard deviation of the speed is about 8 mph. Though the trucks' speed distribution is not actually bell-shaped or

Gaussian, probability theory's Central Limit Theorem shows that when the speeds of all trucks are combined, the result is Gaussian. The mean of the fleet speed is the sum of the mean vehicle speed. The variance is the sum of the variances.

From the number of vehicles and the average freeway speed, the mean speed is

$$\left(\frac{200 \text{ vehicles}}{\text{fleet}} \right) \left(\frac{45 \text{ miles}}{\text{hour}} \right)$$
$$= \left(\frac{9,000 \text{ miles}}{\text{hour}} \right)$$

and the standard deviation of the fleet speed is

$$\sqrt{200 \times 8^2} = \frac{113.14 \text{ miles}}{\text{hour}}$$



New OMNI-LOC™ will give it to you straight

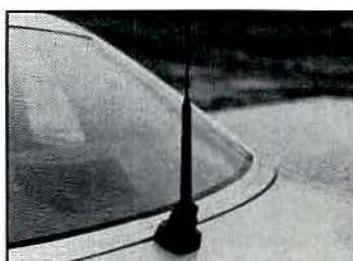
Angle adjustment in any direction without tools! Our new elevated-feed-point cellular antenna gives maximum performance, even in problem installations.

OMNI-LOC™, an ingenious angle-adjusting mechanism, makes Model ASPD917 perfect for vehicles with sloping decks or angled trunk lids. Loosen the knurled angle locking nut, adjust the mast to vertical, and turn the nut to tighten.

The versatile ground-plane-independent design is also ideal for convertibles and other off-roof applications. Mounts quickly with two nylon-tipped set screws — no holes to drill.

For added convenience, the one-piece stainless steel whip is removable and needs no cutting or tuning. We've even covered it with a tough black DURA-COAT™ finish for long life.

See our new Model ASPD917 with OMNI-LOC™ now. It's one more reason you should count on A/S to help straighten your problems out.



New OMNI-LOC™ angle-adjusting mechanism keeps mast vertical

Send for your free copy of "THE BOOK" on cellular antennas. Helps you choose from over 40 A/S models.



a member of The Allen Group Inc.

the antenna specialists co.

30500 Bruce Industrial Parkway • Cleveland, OH 44139-3996
TEL NO: 216/349-8400 • TLX NO: 4332133

© Copyright 1989 by The Antenna Specialists Co.



Circle (34) on Fast Fact Card

Therefore, 99.9% of the time, the fleet speed is less than the mean fleet speed plus three standard deviations, or 9,339 mph:

$$\left(\frac{9,000 \text{ miles}}{\text{hour}} \right) + \left(\frac{3 \times 113 \text{ miles}}{\text{hour}} \right)$$
$$= \left(\frac{9,339 \text{ miles}}{\text{hour}} \right)$$

With a modem that uses 80-bit messages for automatic vehicle location (AVL) updates, the maximum required bit rate is 208 bits per second:

$$\left(\frac{9,339 \text{ miles}}{\text{hour}} \right) \times \left(\frac{80 \text{ bits}}{\text{mile}} \right)$$
$$\left(\frac{1 \text{ hour}}{3,600 \text{ seconds}} \right)$$
$$= \left(\frac{207.533 \text{ bits}}{\text{second}} \right)$$

► **Additional overhead**—Once the user's throughput has been determined, the customer must evaluate the additional overhead a modem requires. Typical overhead sources are forward error-correction (FEC) coding, the preamble and the header. Figure 1 on page 42 shows how the user's data typically are placed in blocks.

Coding schemes are selected based on carrier frequency, vehicle speed and available computing power at the receive end. For the two examples, a

When we talked to technicians about service monitors, they told us they were too busy to talk.

Now, the new HP 8920A solves test problems in less time, so you have more.



In radio testing, you have to work fast to keep up. And when it comes to working fast, the new HP 8920A RF Communications Test Set can put you way ahead. For just \$13,800.*

It's ready to go when you are. Just connect your AM, FM, SSB or cellular radio to the HP 8920A to get receiver results. Push the TX key to automatically tune and measure transmitter frequency, power, deviation and audio power. Push another key for full duplex measurements.

And it goes wherever you need it. At only 35 pounds, the HP 8920A has all the precision troubleshooting tools you need in the shop or field. That includes an oscilloscope, duplex signal generator, AC/DC voltmeter and optional signaling encoder/decoder. You can add a spectrum analyzer with built-in tracking generator and RF probe to make short work of hard problems. And a built-in controller lets you automate routine tasks.

So, if test problems are tying you up, talk to HP. Call 1-800-752-0900, and ask for Ext. 2149. We'll send you a free video that shows how fast the HP 8920A can give you more time.

There is a better way.

 **HEWLETT
PACKARD**

*U.S. Price only.
©1991 Hewlett-Packard Co. TMSPK101A/MRT

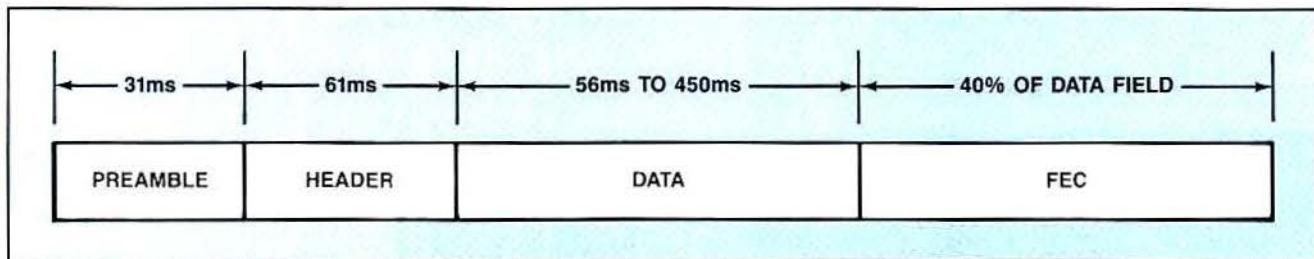


Figure 1. How the user's data typically are placed in blocks.

Reed-Solomon code is used. It adds 40% to the user's data.

Preamble bits are sent at the beginning of each transmission so the receiving modem can determine the proper sampling points on the received waveform. The preamble affects the bit rate by lowering the contention control scheme's efficiency. (Contention control is described in a following section.)

Header bits are sent between the preamble and the data field. The header contains synchronization bits for establishing byte boundaries; source and destination bits for routing and identifying the message; and miscellaneous system protocol bits.

In the police department example, the reports are divided into seven 315-character blocks. One header is used for each block, and each request for information uses one header. When overhead is added to the blocks, the average required bit rate changes from 238 bits per

second to 380 bits per second.

For the traffic center example, one header is used for each 80-bit message. This overhead raises the peak bit rate from 208 bits per second to 1,053 bits per second.

► **Contention control**—The final consideration for determining the bit rate

is the network's contention control scheme. The contention control scheme is the method used for keeping all other mobiles off the channel when one is transmitting.

The most efficient scheme for a large fleet is digital sense multiple access (DSMA). A practical DSMA system using 31ms (150 bits at 4,800 bits per second) of preamble and voice-grade FM radios with 50ms attack time has a maximum throughput of 45%. This means that if the bit rate is 4,800 bits per second, then an average of 2,160 bits per second are decoded at the base. A safe peak operating point for a DSMA system is 35%.

One more look at the two examples:

The police department requires an average of 380 bits per second. If some officers wait until the end of their shifts to type reports, the channel will be more congested and, consequently, slower to process critical requests for information. If a 4,800 bits-per-second modem is used for this application, the DSMA scheme would allow 1,680 bits per second. A peak loading factor of about 4.4, therefore, will be accommodated.

The traffic center's demand statistics, on the other hand, are fairly constant because as the number of vehicles rises, the instantaneous fleet speed tends to be close to the mean fleet speed. Again, using the 35% figure for DSMA, 99.9% of the time a bit rate of 3,008 bits per second would suffice. If a 4,800 bits-per-second modem were used in this application, it would have extra capacity. This extra capacity could support additional vehicles or allow some voice communication between the drivers and the dispatcher.

Next: How to use laboratory measurements to determine a modem's performance. Using the laboratory techniques, you can compare modems that use different modulation techniques.

The ULTIMATE PROTECTION...

Rich, full-grained leather cases for the latest models in stock now!

NOBODY...but NOBODY
beats the quality
and workmanship of LEATHERSMITH's cases
for two-way radio equipment.

LEATHERSMITH's specially-developed, steer hide leather cases are expertly designed by Pennsylvania craftsmen.

LEATHERSMITH's cases feature durable, rust-proof nickel-plated snaps and fasteners. Quick disconnect swivels are optional on all models in polished steel and sturdy molded nylon.

Your choice of covers is included in our low, low prices.

"Delivered on time ALL the time!"
Call TODAY for your FREE information pack
Toll-Free 1-800-233-0440 Fax 1-717-270-2912



LEATHERSMITH
2001 Maple St.
LEBANON, PA 17042

Circle (94) on Fast Fact Card



The MTL™ Portable Radio: High Performance; Not High Priced

Here it is—the affordable, fully loaded radio you've been waiting for—the MTL™ Portable Radio. It's the tough, high-performance portable that's easy on your budget.

The MTL is packed with features you'd expect to find only in higher priced radios—features like dual-priority scan. With scan, you can continuously monitor all 16 channels, including two priority channels. So you won't miss important calls.

Built to demanding MIL-STD 810 C&D specifications, with a

durable all-metal body, the MTL is engineered for performance, efficiency, and value:

- Easy-to-handle top-mounted rotary controls
- Weather-sealed construction
- A recessed emergency button, positioned for one-handed operation
- Compatible with all GE M-PD™ accessories

The MTL Portable Radio is well designed, solidly constructed, and easy to maintain. Changing functions is fast and economical because it's PC-programmable.

And naturally, you get expert field support directly from Ericsson GE or an authorized facility.

If you thought only top-priced radios offered top-of-the-line features, we have good news for you. For more information, write Ericsson GE Mobile Communications Inc., Mountain View Road, Lynchburg, Virginia 24502. Or call toll-free **1-800-GE-12345**.



Mobile Communications

APCO national conference '91 preview/guide

Sophisticated public safety communications-related equipment inundates the Associated Public-Safety Communications Officers annual conference and exposition, and this year's 57th annual event in Tulsa, OK, is no exception with more than 175 commercial exhibitors.

More than 4,500 public safety professionals will convene in the Tulsa Convention Center Aug. 12-16 to consume the latest technology firsthand and explore the future in public safety communications offerings.

Conference sessions will detail national and legislative developments that affect the public safety sector; frequency congestion; designing and implementing radio communications systems; communications centers of the future; and other illuminating data.

The exhibition extends two days, and seminars span five days. The keynote speaker at the Aug. 12 opening breakfast is former Oklahoma Gov. George Nigh. For a review of other conference sessions, refer to the show guide that will be available in Tulsa.

For your convenience, *Mobile Radio Technology* has compiled a list of exhibitors and a section on their new and existing products and services that will be displayed at the convention center. Use this section to "preview" exhibits and

as a guide to products and services offered by the various manufacturers. Corresponding Fast Fact numbers for products and services may be circled on the card in the back of the magazine to obtain more data from the vendors. Advertisers in the section **are highlighted in blue** with a page number reference to

their ads, so you can refer to the ads for additional information.

Use the show floor map on page 46, in combination with the exhibitor list complete with booth number, to find companies' booths at the conference.

The preshow guide includes information that was available as of press time.

Event: Associated Public-Safety Communications Officers National Conference

Dates: Aug. 12-16

Location: Tulsa Convention Center

City: Tulsa, OK

Number of Exhibitors: More than 175

Projected Attendance: 4,500

Exhibit Hours: Tuesday, Aug. 13, 10 a.m. to 6 p.m.
Wednesday, Aug. 14, 10 a.m. to 5 p.m.

Seminar Hours: Monday, Aug. 12, 8 a.m. to 5 p.m.
Tuesday, Aug. 13, 8 a.m. to 5 p.m.
Wednesday, Aug. 14, 8 a.m. to 5 p.m.
Thursday, Aug. 15, 8 a.m. to 5 p.m.
Friday, Aug. 16, 8 a.m. to 5 p.m.

Registration/Hotel Information: 800-824-1850

Be sure to pick up a copy of *Mobile Radio Technology* in the publication bins at APCO.

POWER UP... with ASTRON.

Astron Corporation is the leading manufacturer of high-quality power supplies and converters for the land mobile industry.

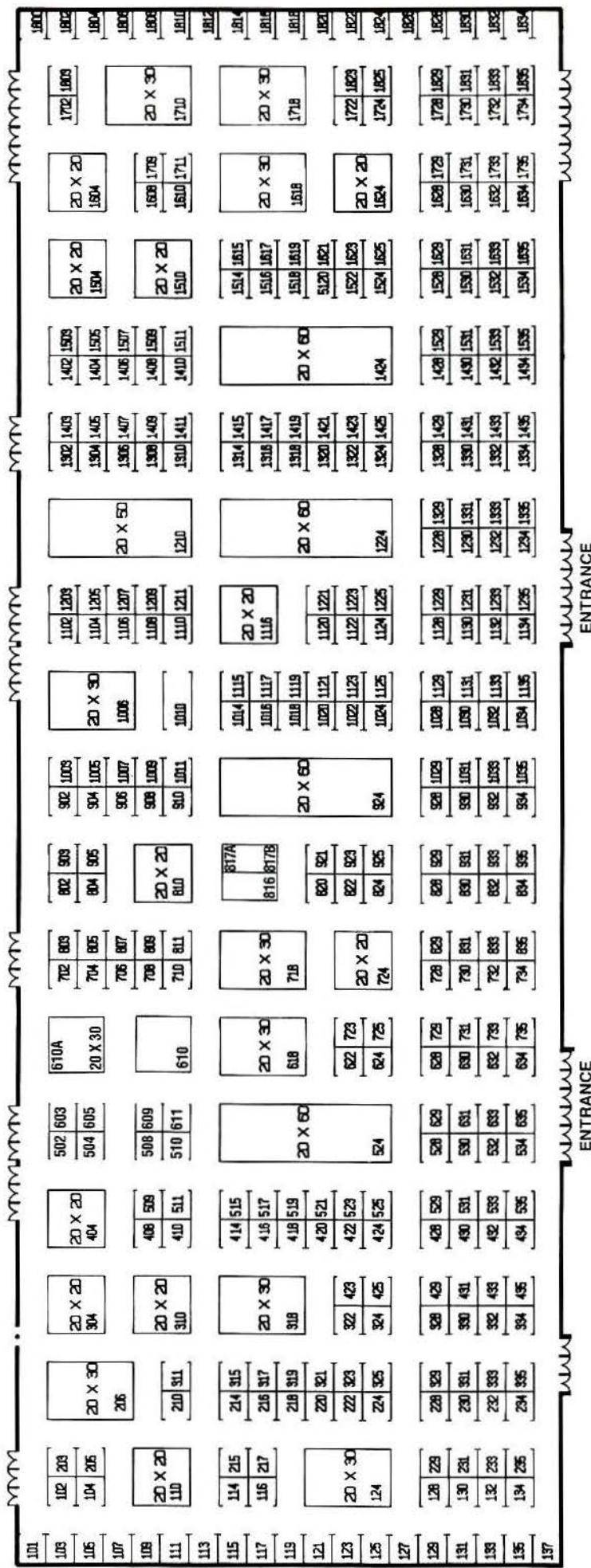
With the new SL-11 series of low profile power supplies, specifically designed for base station applications, the setup is simple, easy and looks attractive. Just mount the radio, with the mounting pads (supplied with the power supply), to the top of the SL-11A (2 3/4" H x 7 1/8" W x 9 3/4" D) or the SL-11R (2 3/4" H x 7" W x 9 3/4" D). The power supplies are very well regulated and will provide 11 amps of current at a 50% duty cycle. The units have fold-back current limiting to protect them from overload and short circuit, and an overvoltage protection feature to protect the radio should the output voltage exceed a safe level. All SL series units are available in dark gray or black.

Power supplies and converters from Astron: our unsurpassed quality and reliability have made us the #1 choice in the communications industry.



ASTRON
CORPORATION

9 Autry, Irvine, CA 92718
Telephone: 714/458-7277
Facsimile: 714/458-0826



APCO

Exhibitor list

- AT&T (1424)
 Advance Label and Tag (1628)
 AER-Aerotron (832, 834)
 Alexander Batteries (533)
 AM/Comm Systems (1028)
 AmeriCom Systems (1509)
 Ameritech Information Systems (127)
 Antenna Specialists (633, 635)
 Appropriate Data Communications (1419)
 Atis (1812)
 Avtec (515, 517)
Bendix/King Mobile Communications (1510)
 Braley Communications Systems (831)
 Bull Worldwide Information Systems (1122, 1124)
Cadex Electronics (1018)
 Call One (1410)
 Cardion Electronics (528)
Cellular Business magazine (Publications bin)
 Celwave (724)
Centurion International (1123, 1125)
 CML Technologies (431, 433, 435)
 Combined Technologies (1308)
Communications Associates (1428, 1430)
 Communications Data Services (1131)
 Commutech (630)
 Concepts To Operations (925)
 Console Systems (618)
CT Systems (828)
 Dantel-Lac (113)
 Data Radio (1528, 1530)
 DCT-Network Analyzers (1417)
 Decatur Electronics (1117)
Decibel Products (529, 531)
 Dictaphone (632, 634)
 Digital Recorders (1435)
 EAI Systems (1504)
 E. F. Johnson (924)
 ElectroCom Telecommunications (618)
 ElectroSonic (229)
 EmergiTech (1115)
Ericsson GE Mobile Communications (524)
 ETG (628)
 Eventide (215, 217)
 FailSafe Magnetics (811)
 Federal Signal (708, 710)
 Firecom (923)
 Fluor Daniel (332)
 Fujitsu Ten Corporation of America (1423, 1425)
Gamber-Johnson (1235)
 Glenayre Electronics (1022, 1024)
 Granger-Telettra (1332, 1334)
 GRID Systems (1207)
 GTE Government Information Services (418, 424, 519, 525)
 GTE Mobile Communications (428)
 Harris (822, 824)
 Harris Farinon (408, 511)
 Heischman (1328, 1330)
Hewlett-Packard (802, 804)
 Hughey & Phillips (1429)
Icom America (1010)
IFR Systems (1129)
 Infocel (1209, 1211)
 Informer Computer Terminals (1120)
 Intergraph (214, 224, 315, 325)
 International Business Machines (833, 835)
International Crystal Manufacturing (729)
 Kaval Electronics (1108, 1110)
Kenwood USA (1029, 1031)

If This Looks Familiar... Take A Closer Look.



This 16 lb.* Monitor Now Does More—Even Better!

The FM/AM-500A

"Micro-Monitor" from 

From the beginning, we have always kept with our commitment to offer the highest quality, along with the best value, of any service monitor available. We are sure you will agree that the FM/AM-500A is superior to any low cost monitor on the market today...and most costing thousands of dollars more.

You asked for more features and here they are — All Standard with the FM/AM-500A:

- FM Signal Generator
- AM Signal Generator
- Sensitive 2 μ V Receiver for AM, FM and SSB
- ◆ 10 Hz to 9999.9 Hz Audio Generator
- ◆ Audio Frequency Error Meter
- 1 kHz Audio Generator
- ◆ Average and Peak Reading RF Wattmeter (automatically protected generator output to 150 watts)
- ◆ Frequency Error Meter with 1 Hz Resolution
- ◆ FM Deviation Meter to 60 kHz
- % AM Modulation Meter
- ◆ SINAD/Distortion Meter
- 0.5 PPM TCXO
- Audio Demodulator Output
- Microphone Input
- External 10 MHz Reference Input
- Weight: 16 lbs. (7.2 kg) approximately *22 lbs. with optional battery
- Size: 11.5" wide, 4.9" high, 14.3" deep (29.2 x 12.4 x 36.3cm)
- Low Price

◆ Added features

Optional Features Include:

- 0.2 PPM TCXO
- 0.05 PPM Hi-Stability Oven Oscillator (Simulcast Paging)
- Internal Rechargeable Battery (Approximately 2 hour Operation)
- High Output Amplifier (+ 30 dB Gain)
- Microphone
- ANT-2 Telescoping Antenna

Features...Performance...and Dependability...the IFR commitment. To see why we say "the best is cost effective", contact your authorized IFR distributor in your area today for a demonstration.



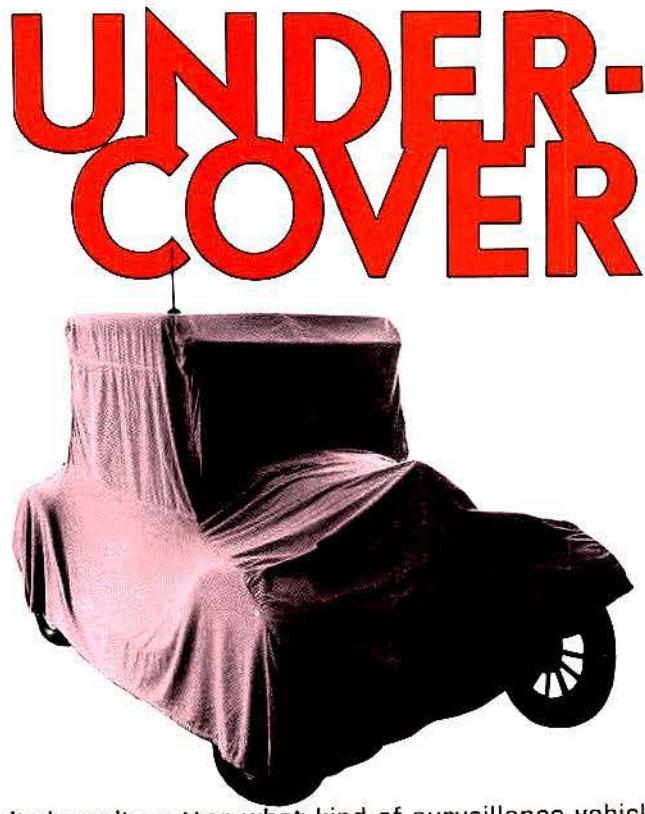
IFR SYSTEMS, INC.

10200 West York Street
Wichita, Kansas 67215 U.S.A.
Phone 316/522-4981
TWX 910-741-6952
FAX 316/524-2623

Exhibitors continued from page 46...
Keystone Information Systems (1121)
Kiewit Network Technologies (820)
Kustom Electronics (816A)
Kustom Signals (1020)
Kyodo West (1434)
Larsen Electronics (1233)
Leach Mounce Architect/Schema (817, 817A)
Logistic Systems (335)
Magnasync (629, 631)
Magnavox/Nav-Com (1133, 1135)
Marconi Instruments (1529)

Markel Insurance Service (210)
MaSys (928)
Maxrad (930)
McCaw Cellular Communications (1030, 1032)
Medical Priorities (1503)
Melillo Consulting (1411)
Microwave Data Systems (1119)
Microwave Networks (1011)
Midland LMR (1514, 1524, 1615, 1625)
Mobile International (735)
Mobile Mark (532)
Mobile Radio Technology (Publications bin)

Modular Communications Systems (622, 624, 723, 725)
Motorola (1224, 1314, 1324)
MX-COM (1310)
Navigation Data Systems (510)
NEC America (429)
NENA (Booth not assigned)
OKI telecom (1630, 1632)
Orbacon (328, 330)
Plant Equipment (1221, 1223)
PolyPhaser (1228, 1230)
Positron Industries (502, 504, 603, 605)
PRC Public Management Services (1116)
Proctor & Associates (1203)
Prototype (534)
Public Safety Systems (1128, 1134)
Racial Recorders (903, 905)
Radiation Systems, Mark Antennas (1421)
Radix (1533, 1535)
RAM Communications Consultants (609, 611)
Ram Mobile Data (430, 432)
Recordata West (829)
Rehm Communications (1231)
Rocky Mountain (1729)
Rohn (1634)
SAI Technology (114, 116)
Scala (535)
SCC (810)
Schlumberger Technologies (1433)
Scientific Dimensions (329)
Security Information Network (508)
Setcom (1229)
SFA (1333)
Shinwa (110)
Signal Communications (1532, 1534)
Skaggs Telecommunications Service (318)
SoftWright (1531)
Solid State (610)
Southwestern Bell Telephone (1006)
Spectracom (414)
Spilsbury Communications (1028)
Starkey Labs (1310)
Sti-Co Industries (732, 734)
Sweet Computer Services (235)
Systemhouse (1633, 1635)
Teac America (731)
TeleSciences Transmission Systems (1722, 1825)
Teletac (931, 933, 935)
Telex Communications (733)
Teltone (1629)
Tibiron PSW3 (1329, 1331)
Tower Structures (1009)
TPL Communications (1826)
Trace (234)
Transcript International (908, 910)
Trident Technologies (1835)
TRW (1302, 1304, 1306)
TWR Lighting (311)
TX RX Systems (1232, 1234)
U.S. Telecom International (830)
US West Public Safety Group (702, 704, 706, 803, 805, 807)
Ultratec (231)
Unisys (1014, 1016)
V Band (1415)
Valmont Industries (929)
Vega (1225)
Watson Furniture Systems (434)
Western Data Communications (1431)
Whelen Engineering (331, 333)
Yuen USA (322, 324, 423, 425)
Zetron (728, 730)



It doesn't matter what kind of surveillance vehicle you drive — if you need **total disguise** for your two-way radio system, STI-CO offers more than 250 antenna models in over 50 body styles.

STI-CO's disguised cellular style antennas fit **any car**.

For low band, high band, UHF — **any band** — STI-CO has the quality disguised antennas you need.

We've got you covered!

STI-CO
INDUSTRIES, INC.

11 COBHAM DRIVE ORCHARD PARK, NEW YORK 14127-0656 (716) 662-2680

Circle (39) on Fast Fact Card

Visit us at APCO, Booth 732.



MAGELLAN 5-CHANNEL GPS TECHNOLOGY.

A universe of applications at a down-to-earth price.

The Global Positioning System (GPS), the most accurate, worldwide navigation and positioning system available, is more accessible than ever. Magellan announces a highly affordable, five discrete channel OEM GPS receiver module to meet all your GPS integration needs. Five continuous tracking channels provide:

- Uninterrupted one-second position updates • Superior tracking in high-dynamic environments and areas of obstructed satellite visibility • No degradation in RF sensitivity (unlike multiplexed receivers).

Magellan's five-channel OEM receiver module is still the most affordable on the market, and is plug-, form- and software-compatible with its single-channel OEM module.

The use of Magellan's exclusive gallium arsenide/MMIC

technology and digital signal processing allows this C/A code module to easily accommodate a vast array of applications, including: • vehicle tracking • avionics • military • vehicle navigation • marine • scientific.

Custom-tailored to your needs.

To help you move into these rapidly expanding markets, Magellan offers the added flexibility of customized hardware and software configurations to meet your specific needs.

Leading the field in advanced GPS technology, Magellan components have been integrated into a wide variety of applications for customers in diverse markets throughout the world, and have proven to be exceptional in quality and reliability. Whatever your GPS application, look to Magellan for low-cost, high-tech technology solutions.



MAGELLAN
WE BRING GPS DOWN TO EARTH™

For more information, contact: Magellan Systems Corporation, 260 E. Huntington Drive, Monrovia, CA 91016.
Phone: (818) 358-2363 Fax: (818) 359-4455. Magellan™ is a trademark of Magellan Systems Corporation.

Circle (40) on Fast Fact Card

Products and services

For more information on the products and services listed, fill out and return the Fast Fact Card on page 123. See example below.



Information listed was accurate at press time and is subject to change.

New products

Replacement batteries for Shinwa, Rehm, Yaesu and Icom radios; replacement batteries for Motorola Micro-Tac, Oki and Fujitsu cellular phones.

Circle 203

See ad page 94

AM/Comm Systems **Booth 1028**

Existing products

Voice logging systems; instant recall systems; digital voice repeaters.

New products

Spilsbury DVR 1001 and 2001.

Circle 204

See ad page 94

Advance Label and Tag

Booth 1628

Existing products

Two-way radio and pager labels for identification of departments, frequency and call codes; service repair tags; tamper-proof, bar code and serial number labels; sew-on and heat-set uniform labels.

Circle 201

See classified ads

AER-Aerotron

Booths 832, 834

Existing products

Lancer-P portable VHF and UHF; Lancer-M wideband mobile transceiver; Mega-E synthesized FM mobile transceiver; community repeater 90W and 40W RF output.

Circle 202

See ad page 73

Alexander Batteries

Booth 533

Existing products

NiCd replacement batteries for portable two-way radios, cellular phones and pagers; battery maintenance systems; sealed lead-acid, alkaline and mercury batteries.

Ameritech Information Systems **Booth 127**

Existing products

Automated control of evidence; computer-aided dispatch.

Circle 205

Antenna Specialists

Booths 633, 635

Existing products

AP-852 series On-Glass antennas for trunking and cellular; ASP-1860 series public safety trunking mobile antennas; ASP-910 series elevated-feed trunking antennas; Armor-Flex portable molded antennas for hand-held radios.

New products

All black line of ASP-1450 and ASP-1650 series

-- **EMR** --
CORP.

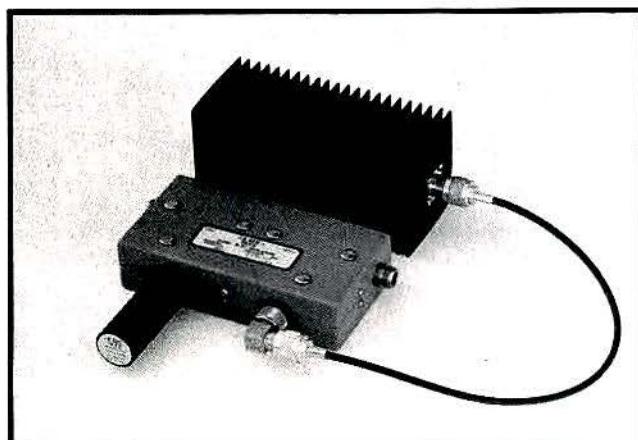
ELECTRONIC DESIGNS AND CONSULTING SERVICES

FOR THE TWO-WAY COMMUNICATIONS INDUSTRY

22402 N. 19th Avenue - Phoenix, Arizona 85027

Tel: 602-581-2875 - Fax: 602-582-9499 - Tlx: 650 287 6957

HIGH POWER R.F. ISOLATORS



66 - 100 MHz - 150 WATTS
100 - 225 MHz - 250 WATTS
400 - 520 MHz - 350 WATTS
800 - 960 MHz - 450 WATTS

CONTACT US FOR INFORMATION COVERING OUR COMPLETE LINE OF RF FILTERING EQUIPMENT

Circle (41) on Fast Fact Card

SIGNAL-TO-NOISE Voting Comparator



Improve coverage by adding receivers

- Expandable to 32 Channels
- Continuous Voting
- 19" Rack Mountable
- Select/Disable Switches for Manual Override
- Can be used with RF Links or Dedicated Lines
- LED Indicators
- Hundreds in Service
- More

— Competitively Priced —

For more information call or write:

Doug Hall Electronics
Voter Dept.
815 E. Hudson St.
Columbus, Ohio 43211
(614) 261-8871

Circle (42) on Fast Fact Card

SAME DAY SHIPPING

Phone or FAX us your order
and we'll ship the same day.

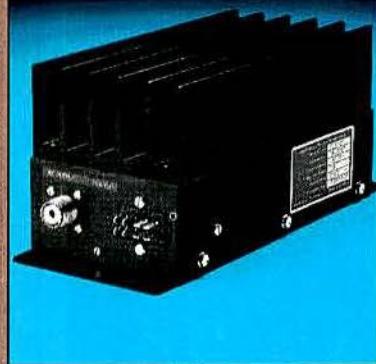
Tempo™ Mobile Radios

Economical, reliable mobile transceivers are available for immediate shipment. Several models offer a choice of features to the two-way customer. Type accepted for all business and public safety uses.



RF Power Amplifiers

We've got RF Amplifiers in stock. Delivery when you need it. Guaranteed to specs, year after year. We've got our dependable reputation behind these products and offer them at realistic prices. You can count on Henry Radio!



Affordable Wireless Data Recorder

At only \$595.00 printed communication between base station computers and mobile units is now affordable for everyone. The AR2400 stores and prints messages or receives and prints simultaneously. Easy to operate; compact size; full 40 characters per line printer output.

Also available, other computer and data transmitting products.



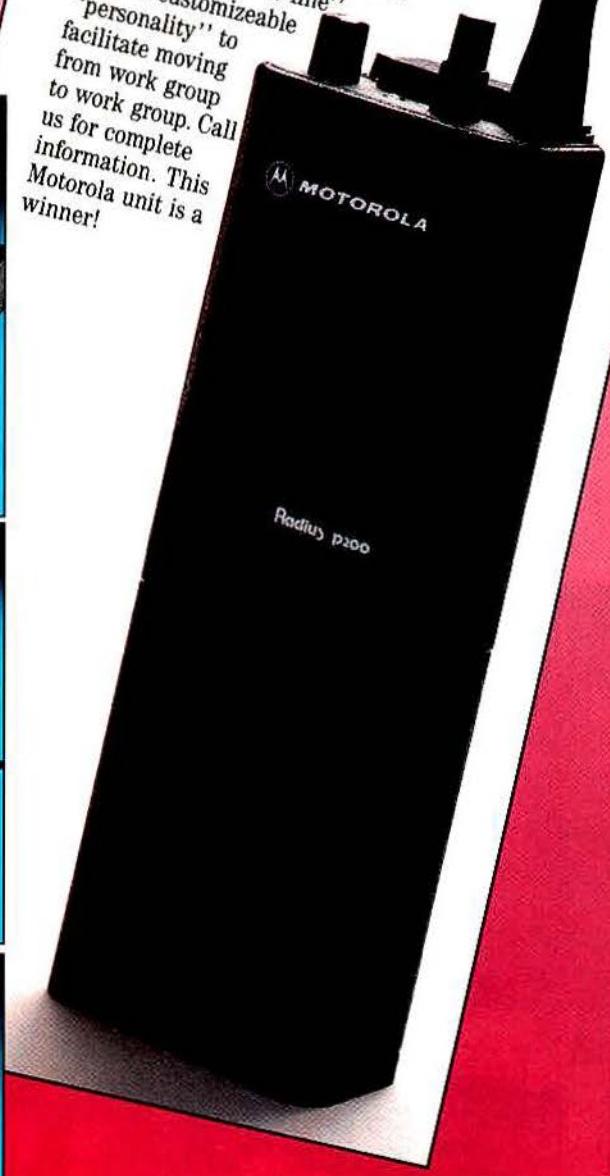
2050 S. BUNDY DRIVE, LOS ANGELES, CA 90025,
TOLL FREE: 1-800-877-7979, FAX: 1-213-826-7790

ALSO IN STOCK: AEA Radio Data Products, ALEXANDER Batteries, RF Connectors, ASTRON Power Supplies, BIRD RF Wattmeters, CENTURION Antennas, COMM SPEC Tone Products, CONNECT SYSTEMS Telephone Interconnects, EIMAC RF Tubes, HENRY RF Amps, HOXAN Photovoltaic Panels, HUSTLER Antennas, ICOM Radio Products, JABRO Batteries, LARSEN Antennas, MAXON Commercial Radios, MOTOROLA RADIUS Radios, MULTIPLIER Batteries, PIPO Touch Tone Pads, TEMPO Commercial Products, UNIDEN Scanners, YAESU Commercial Products.

Circle (43) on Fast Fact Card

Radius™ P200 Synthesized Portable Radio

This radio is truly state of the art with many innovative features to provide excellent flexibility. 2 or 6 channel models available. Coded squelch capable for "private-line" use and customizable "personality" to facilitate moving from work group to work group. Call us for complete information. This Motorola unit is a winner!



HENRY RADIO™

COMMUNICATIONS EQUIPMENT
IN-STOCK AND READY TO SHIP.

APCO

of VHF and UHF Dura-Flex mobile antennas.
Circle 206

See ad page 40

Appropriate Data Communications **Booth 1419**

Existing products
Alarm retransmission system and software; S.A.N.T.A event notification system.
Circle 207

Atis **Booth 1812**

Existing products
MCS-500 cassette voice recorder; MCR-100 surveillance body recorder; IR-30U digital instant recall recorder; Phonak radio surveillance accessories.
Circle 208

Avtec **Booths 515, 517**

Existing products
Advanced concept communications exchange and signaling system (Access); color touchscreen integrated radio and telephone dispatch consoles with as many as 240 lines and 45 operator positions.
Circle 209

Bendix/King Mobile Communications **Booth 1510**

Existing products
LPH5140 and 5142 VHF portables; LPU 4140, 4141, 4421, 4991 UHF portables; LPX 2101 800MHz portables; LMX II01 800MHz mobile and LMH VHF mobile; microphones; base sta-

tions; signaling; and batteries.

New products
EPH 5991A VHF portable.
Circle 210

See ad page 85

Braley Communication Systems **Booth 831**

Existing products
Command post models ML400 and ML500 portable cellular fax products; communication systems integrating facsimile and computers with cellular telephones and mobile radios.
Circle 211

Cadex Electronics **Booth 1018**

Existing products
C2000 series analyzer (four-pocket stand-alone unit); C6000 series battery maintenance system and analyzer.
New products
C4000 series programmable battery maintenance system and analyzer; CV1000 series vehicular smart charger.
Circle 212

See ad page 70

Call One **Booth 1410**

Existing products
ACS, Plantronics, GN Netcom and Unex headsets and accessories.
New products
GN Netcom noise-canceling profile series headsets; ACS elation headset.
Circle 213

Cardion Electronics

Existing products
8000 series microwave radio; 9000 series microwave radio; 9500 series DTL multiplex.
New products
900MHz-to-960MHz state-of-the-art microwave radio to cover federal share and Part 94 bands.
Circle 214

Cellular Business Magazine **Publications bin**
Existing products

Cellular Business is the "Journal of Cellular Telecommunications" and the official publication endorsed by CTIA. It is published monthly and provides marketing and engineering information and news of the cellular industry.
Circle 215

Celwave

Existing products
Eagle series antennas; Advantage mobile cellular antennas; base station antennas; transmission line; Rx multicouplers; combiners; duplexers; system components.
New products
Elevated Advantage—elevated-feed antenna PDI0210; Cellular Advantage—triband motorized antenna PDI0207; bidirectional amplifier and RSA system.
Circle 216

See ad pages 20, 21

HAEWA ENGINEERS "TWO-WAY" SATISFACTION



Unsurpassed German Engineering. Over thirty years radio communications experience in 11 countries. On-the-spot dealer support when you need it most. . . . That's how HAEWA defines "two-way" satisfaction. Add to that HAEWA's:

- Iron-clad factory backed 2 year warranty
- Immediate shipment from stock

and you have savings and dependability that translates in any language!

World-Class quality comes home.

HAEWA
CORPORATION
Atlanta, GA • 404-921-3272
(FAX) • 404-921-2896



Circle (45) on Fast Fact Card

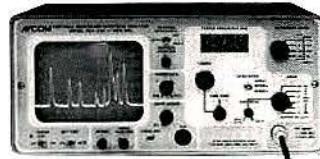
AVCOM's New PSA-65A Portable Spectrum Analyzer

The newest in the line of rugged spectrum analyzers from AVCOM offers amazing performance for only \$2,855.

AVCOM'S new **PSA-65A** is the first low cost general purpose portable spectrum analyzer that's loaded with features. It's small, accurate, battery operated, has a wide frequency coverage - a must for every technician's bench. Great for field use too.

The **PSA-65A** covers frequencies thru 1000 MHz in one sweep with a sensitivity greater than -95dBm at narrow spans. The **PSA-65A** is ideally suited for 2-way radio, cellular, cable, LAN, surveillance, educational, production and R&D work. Options include frequency extenders to enable the **PSA-65A** to be used at SAT-COM and higher frequencies, audio demod for monitoring, log periodic antennas, 10KHz filter for .2 MHz/DIV range, carrying case (AVSAC), and more.

For more information, write, FAX or phone.



AVCOM BRINGING HIGH TECHNOLOGY DOWN TO EARTH
500 SOUTHLAKE BOULEVARD
RICHMOND, VIRGINIA 23236; 804-794-2500
FAX: 804-794-8284, TLX: 701-545

Circle (44) on Fast Fact Card

JABRO IS QUALITY...



Our goal is to become the primary source for all your rechargeable battery needs. Knowing the importance of your communication requirements, we are committed to manufacturing only the highest quality American-made batteries. We combine that pledge with our strict adherence to the most rigid quality-control program in the industry to provide battery power you can rely on month after month.

Try us on your next battery order . . . either standard or custom power supplies. You'll never be disappointed with our quality or our warranty.



JABRO BATTERIES, INC.

1000 W. 108th Street • Suite 100 • Overland Park, KS 66212 • (913) 471-1000

www.jabro.com

JABRO is an authorized Energy Products Value Added Center

JABRO's Nation-Wide Sales Rep Force . . . Ready To Serve You

EPSTEIN & SIEBEL ASSOC., INC.
16 West Palisade Avenue
Englewood, NJ 07631
201-569-7600

MBS MARKETING, INC.
763 Downing Street
Schenectady, NY 12309
1/800-829-0323

LEWIS & DUNNIGAN CO.
104 Jamesville Road
Syracuse, NY 13214
315-446-5522

STINSON ASSOCIATES
117 N. Eagle Road
Havertown, PA 19083
215-446-8585

DEAN COOPER COMPANY INC.
690 Indian Trail-Lilburn Rd.
Lilburn, GA 30247
404-923-0231

ADM MARKETING ASSOCIATION
1114 N. Ridgegreen Loop
Lakeland, FL 33809
813-859-3633

MICRONICS
999 Bethel Road, Rear Unit B
Columbus, OH 43214
614-442-6677

MIDWEST REPRESENTATIVES
1600 Irongate Circle
Zionsville, IN 46077
317-844-4555

RW SALES, INC.
1563 Como Avenue
St. Paul MN 55108
612-646-2710

NEVCO, INC.
P.O. Box 65082
West Des Moines, IA 50265
515-225-9866

ERICKSON SALES, INC.
8350 Meadow Road, Suite 184
Dallas, TX 75231
214-739-5833

BBS COMMUNICATIONS, INC.
11005 Ralston Road, Suite 101
Arvada, CO 80004
303-422-8810

SOUTHWESTERN MARKETING
8527 Carlton Oaks Drive
Santee, CA 92071
619-562-2422

RMC/ASSOCIATES
414 Pendleton Way
Oakland, CA 94621
415-635-6855

EARL & BROWN CO., INC.
7185 S.W. Sandburg Road
Tigard, OR 97223
503-639-2100

Centurion International Booths 1123, 1125
Existing products

State-of-the-art antennas for land mobile, cellular and cordless telephone applications; replacement battery packs for land mobile radios, pagers and cordless phones; unique hands-free EarCom communication unit for land mobile radios.

New products

Style EXW broadband VHF/UHF antennas with broadbanding network for low VSWR and optimum performance across a wide band of frequencies; uses one antenna with negligible RF inser-

tion loss; high durability; and molded construction for operation at -40° to +85°C.

Circle 217

See ad page 31

CML Technologies Booths 431, 433, 435

Existing products

ECS-1000 E 911 system; Comnode-MRCC radio system; automatic call distributor; PC-operator terminal; ECS instantaneous network backup.

New products

Liberty console; ECS selective routing system.

Circle 218

Concepts To Operations

Booth 925

Existing products

Telecommunications and information systems professional and technical consulting.

Circle 219

Console Systems

Booth 618

Existing products

Microcom dispatch console (3-bay).

New products

Minicom IV desktop four-channel, full-featured dispatch.

Circle 220

DCT-Network Analyzers

Booth 1417

Existing products

SNA300 VHF and UHF 10MHz-to-525MHz portable network analyzer; SNA900 700MHz-to-1,200MHz portable network analyzer.

New products

Updated features on products.

Circle 221

Decatur Electronics

Booth 1117

Existing products

Two PC moving and stationary radar; hand-held and moving radar; Visamax display signs.

Circle 222

Dictaphone

Booths 632, 634

Existing products

Veritrac series 9000 communications recorders; call check message repeaters.

New products

Call check 6600 digital communications recorder.

Circle 223

Digital Recorders

Booth 1435

Existing products

Travelers information station; highway advisory radio.

New products

Solar-powered emergency mobile broadcast system; Talking Highway system.

Circle 224

EAI Systems

Booth 1504

Existing products

Computer-aided dispatch and records management for police, fire and EMS.

New products

Courts and jail management software; EAI PC workstations and laptop reporting capabilities.

Circle 225

E. F. Johnson

Booth 924

Existing products

Multi-Net and Mini-Net trunked radio systems; Multi-Net trunked mobile and portable radios with accessories; conventional mobile and portable radios with accessories.

New products

Model 8622MN full-duplex Multi-Net trunking mobile radio; Multi-Net system networking enhancements.

Circle 226

ElectroCom Telecommunications Booth 618

Existing products

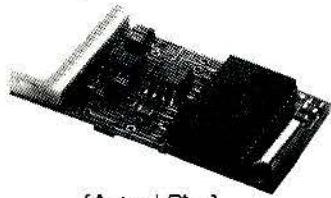
MDT-870 mobile data terminal; MDT-911 mobile status terminal; DPC-1000 data protocol converter.

New products

MDC-890 mobile data computer.

Circle 227

ST-25 MOBILECALL® VOICE ENCRYPTION MODULE



[Actual Size]

A DIGITALLY-CONTROLLED, HIGH SECURITY VOICE ENCRYPTION DEVICE WITH OVER 4 BILLION AVAILABLE CODEKEYS.

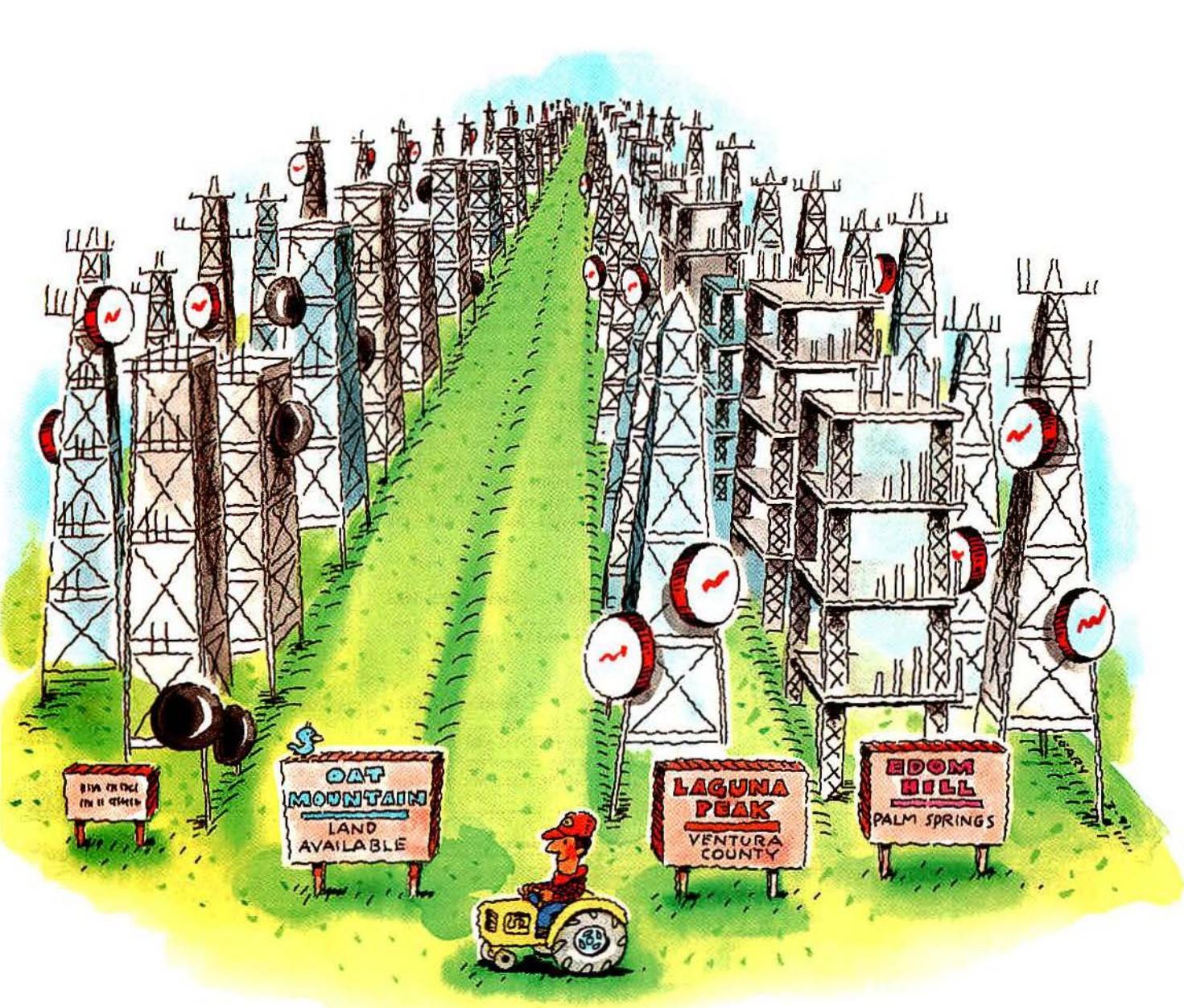
- **High Security** – over 4 billion codekeys!
- **Miniature Size** – measures only 1.5" L x 0.85" W x 0.25" H.
- **High Quality Audio** – high quality, low distortion audio recovery in encrypted mode.
- **Fully Compatible** – with nearly all radio systems.
- **Field Programmable** – with low cost keypad programmer.
- **Low Cost** – At last, an encryption device that costs less than your radio!

FOR FULL FACTS, CALL TOLL FREE: (800) 227-0376

SelectOne

23278 Bernhardt St., Hayward, CA 94545
 [415] 887-1950 • FAX [415] 887-4011

Circle (47) on Fast Fact Card



We're still growing.

When it comes to antenna sites in Southern California, we're the cream of the crop. But we're not about to rest on our laurels—we're expanding to meet the growing needs of our customers.

From our Laguna Peak site, we offer coverage of Oxnard, Ventura and Camarillo. Our Edom Hill site provides coverage that extends from Palm Springs, to Indio, to the Salton Sea. And, for those who want to develop their own antenna sites, parcels of land at Oat Mountain in Chatsworth are now available.

Since 1956 we've been serving a wide variety of companies in both the private and public sectors. In addition to a roster of antenna sites ranging from the Mexican border to the area north of Santa Barbara, we offer capabilities such as secure facilities, standby power and air conditioning, as well as conventional and trunked community repeaters.

But what's most important of all are the long term relationships cultivated by the personal involvement of Rich and Jack Reichler.



Meridian Communications

23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355
(818) 888-7000 • Fax (818) 888-2857

Circle (48) on Fast Fact Card

EmergiTech Booth 1115
Existing products
 Enhanced 911; computer-aided dispatch; police records management; fire records management.
Circle 228

Eriesson GE Mobile Communications Booth 524
Existing products
 Conventional and trunked MTL portable; S-825 control unit; conventional and trunked M-PA portable.
New products
 PCS with scan (conventional portable, dual-priority scan); CRT console; M-PA voice guard (portable with digital encryption).
Circle 229 See ad page 43

Eventide Booths 215, 217
New products
 VR240 digital audio logger.
Circle 230

FailSafe Magnetics Booth 811
Existing products
 24-hour audio logging tape.
Circle 231

Fujitsu Ten Corporation of America Booths 1423, 1425
Existing products
 Citadel series VHF and UHF portables and mobiles.

New products
 Vehicular crossband repeater system.
Circle 232

Gamber-Johnson Booth 1235
Existing products
 DS series modular mounts for any type of voice or data communications equipment. Standard products available for Motorola, MDI, Electro-Com, Kustom, GRiD, Tandy, Toshiba, E. F. Johnson, Zenith, Panasonic and other manufacturers of voice and data communications equipment.
New products

"No holes bored" mounting hardware; DS-ISO shock and vibration isolation mount option; DS-LOCK locking option for DS-series mounting hardware; tamper-resistant hardware option; status and messaging terminal mounting hardware for MDI 7100 series, ElectroCom 911, Kustom KST and the MM-304 for mounting the GRiDPAD.

Circle 233 See ad page 60

Glenayre Electronics Booths 1022, 1024
Existing products
 Simulcast transmitters and control system.
Circle 234

Granger-Telettra Booths 1132, 1134
Existing products
 DTR6/45 6GHz 64 am 45Mb/s digital microwave radio; HR2 2GHz analog microwave radio with low density; DTR2 2GHz digital microwave ra-

dio with medium density; DTM45 digital terminal multiplexer at 45Mb/s; DTI45 digital drop and insert multiplexer.
Circle 235

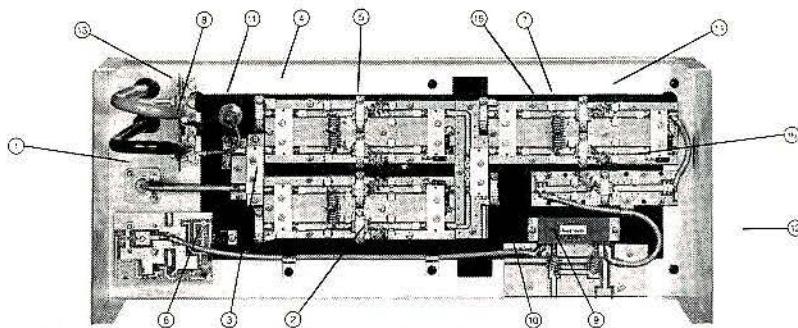
GRiD System Booth 1207
Existing products
 GRiDPAD pin and display; 1720 286 laptop; 1750 3856x laptop; 1550 386SX laptop (hardcase); and 386-486 desktops.
New products
 GRiDPAD pin and display 8086 10MHz.
Circle 236

GTE Government Information Services Booths 418, 424, 519, 525
Existing products
 E911 emergency response systems; computer-aided dispatch; geographic information services and systems.
Circle 237

GTE Mobile Communications Booth 428
Existing products
 Solar-powered cellular callbox with computerized answer and maintenance hardware and software.
New products
 Flashing blue strobe light for quick visual identification of callbox location.
Circle 238

Harris Farinon Division Booth 511
Existing products
 FAS 2/6; DVM 2/10-8T.

16 REASONS TO BUY OUR RF AMPLIFIERS



A bad amp can be your worst nightmare. Ask us what we've been doing over the past 11 years to make your dreams come true. Our Catalog details 16 important technical points you should know before you make a commitment to an RF amplifier supplier. Our product line includes:

- VHF Low Band to 400 watts
- VHF High Band (140-200 MHz) to 300 watts
- UHF Low Band (400-550 MHz) to 400 watts
- UHF High Band (800-960 MHz) to 150 watts
- True continuous rating at high ambient temperatures
- "Bullet-Proof" heavy duty protected amplifiers for mobile and simplex applications

VoCom/RF Corporation

Quality since 1979

1/800-872-6233

Call 1-800-USA-MADE

In Illinois 708/885-3296

Circle (49) on Fast Fact Card

C.E.T., Inc.
ENGINEERING SOFTWARE
 Coverage Predictions
 Intermod Studies
 Fresnel Zone
 Radio Engineering

NEW! DIMENSION 3000

Three-dimensional height and terrain program in full color!

DIAL ACCESS SERVICE
 FCC License-Holder Data Base
 Mailing Labels/Printouts/Data
 Elevation Data Base
 Engineering Programs

**Engineering services: Intermod,
Coverage Predictions,
Calculated HAAT**

Send for our free catalogs

C.E.T., Inc.

1001 S. Ridgewood Ave.
 Edgewater, FL 32132

904-426-0014 Fax: 904-426-0099

Circle (50) on Fast Fact Card

SMR Networking . . .

Call Routing As You've Never Seen It Before:

With a Trident CR-355, affordable cellular-like call routing is available for your LTR® trunking system. It operates like any other DID adapter, with one important difference... Interconnect Networking!

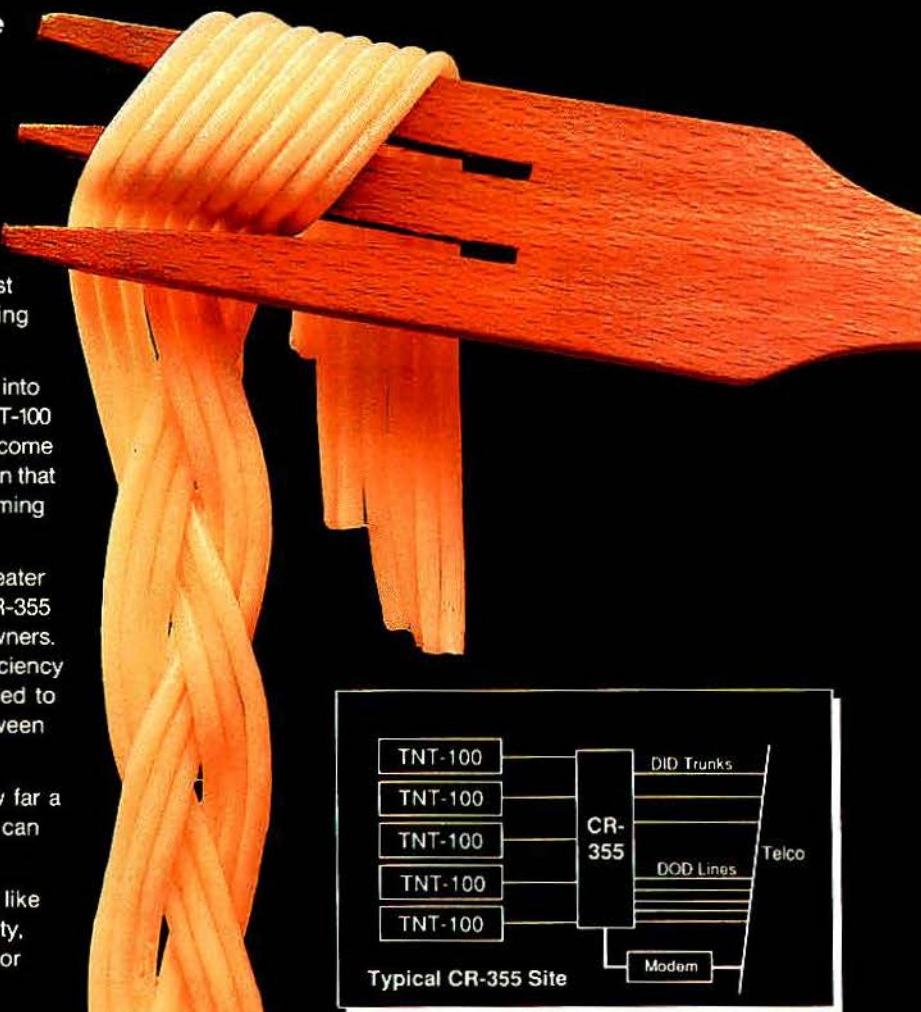
Efficient and Compatible: The CR-355 mates with a universal TNT-100 logic and interconnect controller that can be fitted to any manufacturer's LTR® trunking system. Its features are DID, Least Cost Routing, No Answer Transfer and a billing port to charge for those networked calls.

Real Cellular-Like Roaming: When a mobile roams into another service area, by accessing dial tone the TNT-100 will speak a friendly greeting message to welcome them onto the new system. All roaming information that takes place is transparent to the roamer. Any incoming call will now ring him in the new service area.

Versatility: With 3 DID ports, 5 DOD ports, 5 repeater ports and many feature option packages, one CR-355 allows flexibility to large and small system owners. The use of existing telco lines helps for cost efficiency PLUS the existing mobiles need not be modified to incorporate the networking. Networking between Johnson and Uniden sites is a reality.

No Limits to Roam: There is no limit as to how far a customer can roam when almost everyone can afford a CR-355!

The CR-355 gives you networking capability like you've never had before, together with compatibility, low cost and a user-friendly operating system. For more information, call 1-800-798-7881.



Trident Micro Systems

New products

New release of DVM 6-45; DVM 18-45; Urbanet 23z.
Circle 239

Heischman

Booths 1328, 1330

Existing products

CTS/RC-4 radio console simulator for training;
CTS/FU-4 field unit simulator for training;
CTS/TS3 telephone simulator for training;
CTS/911 E911 simulator for training.

New products

CTS/TS911 redesigned E911 and telephone simulator system, offering an easier-to-use training system.

Circle 240

Hewlett-Packard

Booths 802, 804

New products

HP8920 RF communications test set for AM/FM/SSB radios, pagers, repeaters, cellular telephones and system components.

Circle 241

See ad page 41

Hughey & Phillips

Booth 1429

Existing products

Red and white tower lighting system; fall protection.

New products

Medium-intensity strobe light.

Circle 242

Icom America

Booth 1010

Existing products

R9000; R7000; HI9; HI6; U16; H8; U100; U400; U200 radios.

New products

TC-HI9 hand-held; H-8 hand-held.

Circle 243

See ad page 59

IFR Systems

Booth 1129

Existing products

Radio communications test equipment; spectrum analyzers.

Circle 244

See ad page 47

Infocel

Booths 1209, 1211

Existing products

Computer-aided dispatch and police records management systems for police and fire departments nationwide.

Circle 245

Intergraph,

Booths 214, 224, 315, 325

Dispatch Management Systems Division

Existing products

Demonstrations of the dispatch management system, incorporating computer graphics and interactive mapping with computer-assisted dispatching and digital communications for public safety operations.

Circle 246

International Business Machines (IBM)

Booths 833, 835

Existing products

System status management and computer-aided dispatch (SSM/CAD) system using the IBM AS/400 platform, PS/2 models 95, 80, 55SX and 25 that connect through a radio frequency network to field units using state-of-the-art mobile data terminals with AVL connections for a BARCO service area display.

New products

A sophisticated mobile data terminal, service area mapping with features not currently available in other software packages and a leading edge SSM/CAD for any public safety requirement.

Circle 247

International Crystal Manufacturing

Booth 729

Existing products

Crystals; channel elements; test oscillators; pagers; portables.

New products

FOT 12A test and alignment oscillator.

Circle 248

See ad page 22

Kaval Electronics

Booths 1108, 1110

Existing products

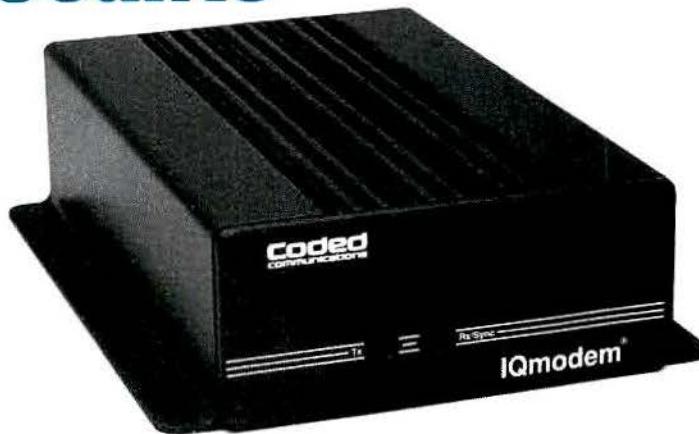
On-frequency repeater; VHF and UHF booster amplifiers; distributed antenna system.

New products

KVB and KUB booster amplifiers.

Circle 249

When Performance Counts



Coded's IQmodem®

Coded's new mobile data modem has already been proven in many large police and fire agencies. The IQmodem is compatible with:

- MDI mobile data networks
- Existing RF equipment
- Laptop computers
- Printers
- Automatic Vehicle Location (AVL) systems

Call today and find out how major public safety agencies are putting Coded's advanced modem technology to work.

For further information, call Coded toll free.

Coded
communications™

Coded Communications, 2375 Camino Vida Roble, Carlsbad, CA 92009
(800) 228-6367 • (619) 431-0077 (Local) • (619) 431-1372 (Fax)

© COPYRIGHT 1991 CODED COMMUNICATIONS CORPORATION

MDI IS A REGISTERED TRADEMARK OF MOTOROLA INC

Circle (52) on Fast Fact Card

ICOM Can Open the Door To All Your Communication Needs



Land Mobile and Public Safety Equipment

Complete UHF and VHF Systems

Custom, OEM & Intrinsically Safe Equipment

Single Sideband / HF Equipment

Short & Long Range Communications

Government Sales & Rental/Lease

Immediate Product Availability

Professional Sales Staff

Nationwide Service Centers

ICOM America, Inc.
2380 - 116th Ave. N.E., Bellevue, WA 98004
(206) 454-8155

All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. CORP#1990

Circle (53) on Fast Fact Card

1 • 8 0 0 • U S A • I C O M

Keystone Information System Booth 1121
Existing products
Computer-aided dispatch system; police and fire records; detention management systems.
Circle 250

Kiewit Network Technologies Booth 820
Existing services
Consulting services: system planning, design, engineering, installation, maintenance, project management, construction and support.
Circle 251

Kustom Electronics Booths 816, 816A
Existing products
Mobile data communication systems.
New products
DXT 20i mobile data terminal.
Circle 252 See ad page 61

Kustom Signals Booth 1020
Existing products
ProKomm I voice communication console; Communicator voice communication console; traffic safety radar.

New products
Eyewitness in-car surveillance system.
Circle 253

Larsen Electronics Booth 1233
Existing products
CM, LM, NLA, NMO and KG series antennas ranging from 25MHz to 1,300MHz; available in various mounting styles and frequency ranges.
New products
NMO150WB-VHF wideband mobile antenna; KGBK-825 clip-on mobile antenna for cellular and SMR portables.
Circle 254 See ad page 81

Leach Mounce Booths 817, 817A
Architects/Schema Systems
Existing products
Architecture for public safety and communications facilities, needs assessments, systems engineering, staffing studies, console design and systems integration.
New products
New concepts in facility and systems design.
Circle 255

Magnavox/Nav-Com Booths 1133, 1135
Existing products
Automatic vehicle location system.
New products
MX-2020P MAGNAPhone portable satellite telephone.
Circle 256

Marconi Instruments Booth 1529
Existing products
Communications test equipment.
Circle 257

Markel Insurance Service Booth 210
Existing products
Insurance for local dispatch units; errors and omissions.
Circle 258

MaSys Booth 928
Existing products
Enfors public safety systems; computer-aided dispatch; fire record; jail systems; MDT support; special communications.
Circle 259

Maxrad Booth 930
Existing products
Lowband, VHF, UHF, 800MHz-to-900MHz portable and mobile antennas; selected base station antennas.
Circle 260 See ad page 27

McCaw Cellular Communications Booths 1030, 1032
Existing products
Cellular telephones from Motorola, NEC and Uniden; emergency telephone backup products by Telular; only provider of cellular hardware on GSA contracts.
Circle 261

Melillo Consulting Booth 1411
Existing services
Computer-aided dispatch consulting services: software selection and design specification; system design and architecture; vendor contract negotiation; interface with state, NCIC and records management databases; training plans; acceptance test

You'll Never Get Us For Non-Support!



Whatever voice and data communications equipment you need to mount, no matter what vehicle you need to mount it in...

We make the mounting hardware for you.
Support for you and your equipment.



Call now for literature. 1-800-GJ-Mount
(1-800-456-6868) Fax 715-344-5209



GAMBER-JOHNSON
Service & Solutions

801 Francis Street, Stevens Point, Wisconsin 54481

Circle (54) on Fast Fact Card

Some Things Are Better Left Unspoken.



Eliminate voice communication and gain privacy, efficiency, and productivity. With traditional voice communication every ear tuned to your radio channel can hear your messages. That can be dangerous. Our mobile data communication systems provide the security needed for your two-way radio communications. Your information can be transmitted with a speed and accuracy

that leave traditional voice communications back at the base station.

Mobile data communication systems are the key to improving efficiency of service organizations, courier and delivery firms, utility companies, taxi and limo fleets and public safety agencies such as police, fire, and emergency medical service.

For more information regarding Kustom's integrated solutions in mobile data communication systems, please call, (800) 255-6311.

K**E** KUSTOM ELECTRONICS INC.

10975 El Monte
Overland Park, KS 66211-1413
(913) 339-6767
FAX (913) 339-6568

procedures; cutover plans; RFP bid specification development; and project management.
Circle 262

Microwave Data Systems **Booth 1119**
New products

MDS 960 series 900MHz point-to-point links, one to 15 channels, non-standby and hot-standby; advanced microprocessor control; and diagnostic capability.
Circle 263

Microwave Networks **Booth 1011**

Existing products
 MicroNet line of short-distance microwave radios including DS1, 4DSI/8DSI and DS3 at 15GHz, 18GHz and 23GHz frequencies.
Circle 264

**Midland Land
Mobile Radio** **Booths 1514, 1524,
1615, 1625**

Existing products
 Syn-Tech XTR mobile radios and desktop dispatch stations; Syn-Tech II mobile radios; Base-Tech dispatch station and repeaters; LMR portable radio series.
New products

70-132/232 compact portable with talk-back paging capability; 70-045 16- and 48-channel lowband synthesized portable radios; Syn-Tech II dualband

control head; 70-195/295 portables with Transcrypt CVP II and CVP III high-security scrambling.
Circle 265

See ad on IFC

Mobile International **Booth 735**

Existing products
 Communications shelters; environmental equipment enclosures; specialty trailers; trunk-mounted equipment enclosures; emergency power units.
Circle 266

Mobile Mark **Booth 532**

Existing products
 Installed and portable cellular antennas including the cordless clip-on portable cellular antenna; glass-mount and portable antennas for UHF and VHF, including a glass-mounted dualband antenna.

New products
 Roof- and body-mount antennas for UHF and VHF with a quick disconnect for the whip and a spring-loaded center pin contactor.
Circle 267

See ad page 101

Mobile Radio Technology **Publications bin**

Existing products
 Written to keep industry professionals up to date on the latest in equipment, technology, techniques, business developments, legal and regulatory matters, **MRT** is recognized as the leading source of technology-oriented industry guidance.
Circle 268

**Modular
Communications Systems** **Booths 622, 624, 723, 725**

Existing products
 Microprocessor-based console Ultra Com 96; microprocessor-based desk console Ultra Com 96DT; microprocessor-based programmable encoder Ultra-Page 96.
New products

Ultra Com-Pro touchscreen console.
Circle 269

See classified ads

Motorola **Booths 1224, 1314, 1324**

Existing products
 Mobile radio communications equipment and systems.
Circle 270

MX-COM **Booth 310**

Existing products
 Pvt Squelch CTCSS-controlled privacy modules to fit most hand-held and mobile radios including Radius, Midland, Motorola and Maxon; MX-P1281 VSB scrambler fits most radios and gives high-security scrambling; MX-P1381 voice storage and retrieval module (Radio MailVox) stores and retrieves messages for mobile radios.
New products

MX-P1283 Cypher-MX VSB for Radius P2000 and Motorola HT600 provides high-level scrambling without the drawbacks of digital processing delay, lost recognition and reduced range.
Circle 271

See ad page 9

What Really Turns You On?

The "Smart Vox", used with any of our audio accessories, will recognize your voice in varying noise - from quiet to deafening - and will consistently turn on your radio . . . but only when you talk. No loss of words at the start of a message, no false keying, no adjustments, no modifications.

How's that for a turn on?

For completely HANDS-FREE, RELIABLE RADIO COMMUNICATIONS, get turned on by our "Smart Vox".



Contact:

setcom
CORPORATION

1400 North Shoreline Blvd.
Mountain View, CA 94043
(415) 965-8020

Circle (56) on Fast Fact Card



When you feel acute chest pains,
call a doctor.

When your teeth are crooked,
call an orthodontist.

When you smell smoke,
call the fire department..



When you have a good hand,
call their bluff.



When you can't tie your shoelaces,
call a dietician.



When you've got it covered,
call "Bingo!"

When you need antennas & cable *FAST*, call Cartwright.



CARTWRIGHT
COMMUNICATIONS COMPANY

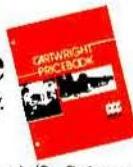
800-543-8614

7812 Red Sky Drive
Cincinnati, Ohio 45249

1-3 Day Delivery Nationwide

Call us by 3:00 PM E.T. and we'll ship the same day.

Circle (57) on Fast Fact Card



Call for our
Free Pricebook
with guaranteed prices
for 3 months.

The most complete source for Andrew, A/S, Celwave and Decibel Products.



National Emergency Number Association	Booth not assigned	SCC	Booth 810
<i>Existing products</i>		<i>Existing products</i>	
NENA News magazines; membership applications.		Computer-aided dispatch; graphic geofile manager; records management systems.	
<i>New products</i>		<i>New products</i>	
Advertising opportunities in NENA News.		Records management system new release.	
Circle 272		Circle 289	
Navigation Data Systems	Booth 510	Schlumberger Technologies, Instruments Division	Booth 1433
<i>Existing products</i>		<i>Existing products</i>	
Fleet-Trak automatic vehicle location systems.		4031 and 4040 Stabilock service monitor; 4922 radio code analyzer; 6910 Minilock surveillance receiver.	
<i>New products</i>		<i>New products</i>	
Status and display terminal; model SDT-911.		4015 Stabilock lightweight radio tester; 9200 series GSM tester.	
Circle 273		Circle 290	<i>See ad page 15</i>
NEC America—Radio Division	Booth 429	Scientific Dimensions	Booth 329
<i>New products</i>		<i>Existing products</i>	
The 21 series GTX Network Management System is a stand-alone graphical interface transmission network management system featuring multitasking operation in X-Windows environment; Unix operating system.		Enhanced mobile stacking system; mobile data mount SDI 7000; two-way portable vehicle mount SDI 6000; quick connection slide mount.	
Circle 274	<i>See ad page 13</i>	Circle 291	
OKI telecom	Booths 1630, 1632	Security Information Network	Booth 508
<i>Existing products</i>		<i>Existing products</i>	
Models 810 and 830 mobile cellular telephones; 891 transportable cellular telephone; 900 microportable cellular telephone.		Communications center alarm notification system that lets alarm users cancel false alarms.	
Circle 275		<i>New products</i>	
		Information transfer system.	
Orbacom Systems	Booths 328, 330	Circle 292	
<i>Existing products</i>		Setcom	Booth 1229
TDM-150 distributed microprocessor console; TDM-150 mini desktop console; Calida desktop 16-channel user-programmable console.		<i>Existing products</i>	
Circle 276	<i>See ad page 17</i>	Headsets, motorcycle helmet com-kits and SCBA com-kits for use with portable and mobile radios.	
PolyPhaser	Booths 1228, 1230	<i>New products</i>	
<i>Existing products</i>		System 1000 vehicular intercom and mixer system.	
Impulse suppressors and EMP protection for coax, data and phone line, dc, power line and grounding products.		Circle 293	<i>See ad page 62</i>
<i>New products</i>		SFA	Booth 1333
IS-CT50HLC trunking and cellular coax lightning protector with LC connectors; IS-CT50H78E trunking and cellular coax lightning protector with 7/8" EIA flanges; IS-MD50LNZ microwave down conversion series.		<i>Existing services</i>	
Circle 277	<i>See ad page 104</i>	Public safety and mass transit communications consulting includes two-way radio, CAD, 911 systems and communications center design and implementation.	
PRC Public Management Services	Booth 1116	Circle 294	<i>See classified ads</i>
<i>Existing products</i>		Shinwa Communications of America	Booth 110
Computer-aided dispatching system; police and fire records management system; mobile data terminals; mapping system integrated with CAD; PCs and workstations.		<i>Existing products</i>	
<i>New products</i>		Moe numeric pager; Checkmate III tone-and-voice pager; GX series portable radio; GIII series portable radio; X series mobile radio; Z series voice storage.	
Laptop personal computers; imaging systems; fire station alerting.		<i>New products</i>	
Circle 278		SR001 all-band receiver; SC9830 trunked mobile radio; FDT series portable radio.	
Prototype	Booth 534	Circle 295	
<i>Existing products</i>			
CMS/PC is a PC-based computer software system that improves the management and maintenance of communications, radio and electronic equipment.			
Circle 279			
Scala	Booth 535		
<i>Existing products</i>			
Antenna solutions for all antenna bands used by public safety agencies. Problems with the new 800MHz requirements are easily solved with directional arrays.			
<i>New products</i>			
CA6-220 yagi is 9dBd gain, 916MHz-to-925MHz broadband antenna.			
Circle 288	<i>See ad page 16</i>		

**Pick up a copy of
Mobile Radio Technology
in the publication bins
at APCO.**

BUSINESS CALLS ON KENWOOD

With a great reception...

Kenwood two-way radios answer every call for on-the-job communications.

With a full line of portables, mobiles, and base station repeaters, Kenwood has a radio for every job. One push of the button establishes an instant, and cost effective link

between office and field personnel. Upgraded new models are loaded with high tech features, and packed with performance power. As well as Kenwood versatility and reliability. And a factory-backed two-year warranty on parts and labor. Business calls on Kenwood...with a great reception.



Check your local Yellow Pages for the nearest authorized Kenwood dealer or call toll-free at: 1-800-950-5005.

KENWOOD

Kenwood U.S.A., Corporation/Land Mobile Radio Sales
P.O. Box 22745, Long Beach, CA 90801-5745
(213) 639-4200, FAX (213) 761-8246

Circle (58) on Fast Fact Card

APCO

Skaggs Telecommunications Service	Booth 318	Spilsbury Communications Existing products	Booth 1028	EMS management software including SweetSoft Dispatch, SweetSoft Ambulance, SweetSoft Car, SweetSoft Crew, SweetSoft Electronic claims and SweetSoft Membership.
<i>Existing products</i>		Desktop, rack-mount DVR1001 digital voice repeater.		<i>New products</i>
Consoles and custom equipment enclosures; dispatch control centers.		DVR2000 digital voice repeater.		SweetSoft Dispatch 3.0; SweetSoft Crew 2.0.
Circle 296	See ad page 39	Circle 300		Circle 303
SoftWright	Booth 1531	Starkey Laboratories Existing products	Booth 1310	Systemhouse
<i>Existing products</i>		Telephone custom headsets.		Booths 1633, 1635
Terrain analysis package software to perform evaluation of existing or proposed transmitter site; radio coverage predictions; microwave and two-way radio system design.		Circle 301		<i>Existing products</i>
<i>New products</i>				Demonstration of fire and EMS computer-aided dispatch system installed in Los Angeles. The system includes computerized mappings, automatic vehicle location system and mobile digital terminal system.
Boundary module to plot political boundaries on coverage maps.				Circle 304
Circle 297	See classified ads			
Solid State Communications	Booth 610	Sti-Co Industries Existing products	Booths 732, 734	Teac America
<i>Existing products</i>		Disguised mobile two-way antennas including fender-mount lowband, highband, UHF and broadband models; cellular look-alike VHF and UHF antennas; low-profile transit antennas in highband, UHF, 800MHz and 900MHz frequencies; special-use antennas; couplers; tuners; and dual-matched systems.		Booth 731
Remote control and selective signaling products.		<i>New products</i>		<i>Existing products</i>
Circle 298	See ad page 3	Custom fender-mount disguised antennas for Olds Cutlass four-door, Ford Ranger, Explorer, Crown Victoria, Tempo, Probe and F-Series trucks; available in lowband, highband, UHF and broadband. Transit radome antenna in 900MHz range; cellular elevated-feed style UHF broadband antennas.		CRI100 series communications recorders.
<i>New products</i>		Circle 302	See ad page 48	<i>New products</i>
Netclock 2 synchronized clock.				CR320 20-channel communications recorder; CR-310 10-channel communications recorder.
Circle 299				Circle 305
Spectracom	Booth 414	Sweet Computer Services Existing products	Booth 235	TeleSciences
<i>Existing products</i>				Booths 1722, 1825
Model 8120 frequency synthesizer; model 8143 signal selector and distribution; model 8165 ageless disciplined oscillator; model 8165 display clock.				Transmission Systems
<i>New products</i>				<i>Existing products</i>
Netclock 2 synchronized clock.				Teletar 18/23; T-Xpander.
Circle 299				<i>New products</i>
				Teletar 2; Teletar 6.
				Circle 306

WIRELESS TELEPHONE EXTEND TELEPHONE WITH **OptaPhone+** by Carlson Communications

PERFECT FOR:

- Emergency or temporary service
- Permanent rural service
- Oil and mineral exploration

FEATURING:

- Up to 120 Km range
- Voice, Fax or data
- 2 or 4 wire circuit
- VHF, UHF or 800 MHz
- 12 volt or -48 volt
- Simple installation
- Now in use by many telephone companies
- Excellent voice quality



CALL OR WRITE FOR A FREE BROCHURE!

800-283-6006 Carlson Communications, Inc.
707-923-2911 655 Redwood Drive
FAX 707-923-2655 Garberville, CA 95440

Circle (59) on Fast Fact Card

NOBODY Does it Better

Selectone

ASTRON
CORPORATION

PANAVISE

CENTURION

EPI
COMMUNICATIONS, INC.

Tyton

LEATHERSMITH

COMMUNICATIONS SPECIALISTS, INC.

Alexander



SAMLEX

CES



TPL

CSI
COMMUNICATION SYSTEMS
INCORPORATED

TRILECTRIC

GAMER-JOHNSON

Your Complete Source For Accessories

primus

ELECTRONICS CORPORATION

18424 South I-55 West Frontage Rd. Joliet, IL 60435
800-435-1636, IL 800-892-1413
FAX 800-767-7605

Circle (60) on Fast Fact Card

NEW

ULTRALINK™

C A B L E

your best connection

Design by Cushcraft/Signals.

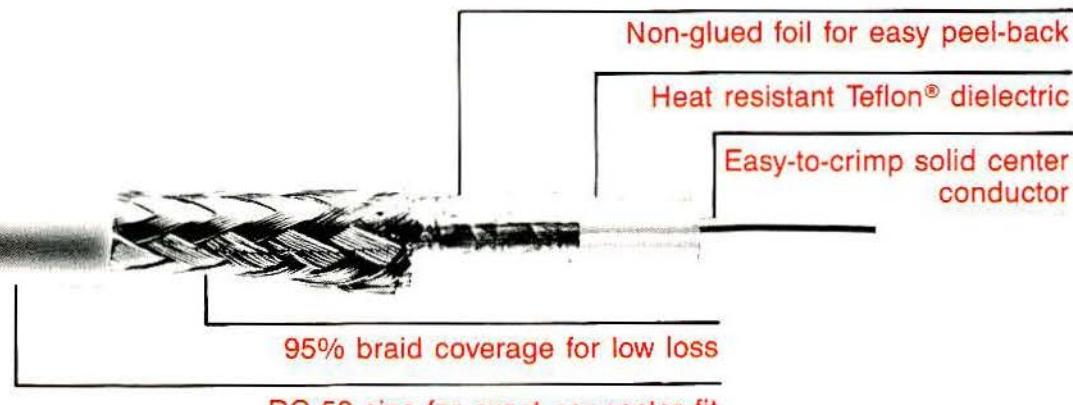
Those few words tell you that UltraLink™ was developed specifically for two-way commercial radio communication by the company that understands the need for proper cable.

Cushcraft/Signals knows the problems that installers have with cables that won't fit the connectors. We know what can happen when hot exhaust pipes contact cable. And most importantly, we know how much signal can be lost between the radio and the antenna.

UltraLink is the RG-58 size cable that withstands heat, is easy to install, and has less than 15dB loss/100 feet at 900MHz. That makes UltraLink your best connection for mobile or control station applications. And that's why UltraLink is supplied with Cushcraft/Signals 800/900MHz antennas featuring low-loss cable!

Call Cushcraft/Signals for a sample. Let your technician strip it and install a connector. You will both be convinced that UltraLink is a superior cable. That's why it carries the Cushcraft/Signals name!

1-800-258-3860



 **cushcraft / Signals**
CORPORATION

48 Perimeter Road, Manchester, NH 03108 USA
603-627-7877 FAX 603-627-1764 TLX 4949472

Circle (61) on Fast Fact Card

APCO

Teletec

Existing products

Omni IQ-1000 148MHz-to-174MHz VHF wideband mobile radio; Omni IQ-1000 450MHz-to-480MHz UHF wideband mobile radio.

New products

Omni IQ-1000 480MHz-to-512MHz UHF wideband mobile radio; IQ-2000 Magnum 148MHz-to-174MHz and 450MHz-to-480MHz dualband mobile radio; IQ-2000 Magnum 450MHz-to-512MHz wideband mobile radio; IQ siren, light bar and radio control unit.

Circle 307

Teletrac

Booths 931, 933, 935

Existing services

Radiolocation network that uses the same spread spectrum technology used by the U.S. military for transmission of sensitive data. Services include: stolen vehicle locator service—instantly detects a theft in progress and monitors the stolen vehicle until recovered; corporate vehicle locator service—enables dispatchers to monitor the status and location of thousands of fleet vehicles with an accuracy of 150 feet.

Circle 308

Telex Communications

Booth 733

Existing products

EM-200 and EM-150 Ear-Mike systems for use with portable radios; Magnacom vehicle intercom system; headsets for use with portable radios;

Booth 718

MagnaRope communications and retrieval system for use in confined space.

New products

HS-955E high noise-attenuating headset designed to be worn under a helmet and with a noise reduction rating of 24dB and a noise-canceling microphone.

Circle 309

See ad page 96

Teltone

Booth 1629

Existing products

911 switched access system; M-106E remote access unit; TLS-3 telephone line simulator.

Circle 310

Tiburon PSW3

Booths 1329, 1331

Existing products

CAD 2000 computer-aided dispatch systems; RMS 2000 records management systems.

New products

Mapping systems; image displays; mobile laptops.

Circle 311

TPL Communications/DX

Booth 1826

Radio Systems

Existing products

RF-power mobile and base station repeater amplifiers; FM repeaters; base stations; radiotelephone links; AM mobile and base stations.

Circle 312

Transcrypt International

Booths 908, 910

Existing products

Scramblers and voice privacy for mobile and cel-

lular radio; digital and analog signaling systems for radio; computer-aided dispatch systems; frequency hopping radios.

New products

3200 ANI and status display systems consoles.

Circle 313

See ad page 5

Trident Technologies

Booth 1835

Existing products

PCT (personal communications terminal) desktop sends and receives information for hearing and speech-impaired people.

Circle 314

See ad page 57

TWR Lighting

Booth 311

Existing products

FAA-approved aviation obstruction lighting; medium-intensity strobes; 300MM red beacons; single and double obstruction lights; controllers; solid state and motor-driven, alarmed and non-alarmed; junction boxes; complete light kits.

Circle 315

TX RX Systems

Booths 1232, 1234

Existing products

Duplexers; filters; multicouplers; repeater amplifier systems; RF system products; associated hardware.

Circle 316

See ad page 28

Unisys

Booths 1014, 1016

Existing products

Aplims; Stops.

Circle 317

COMTELCO INDUSTRIES, INC.

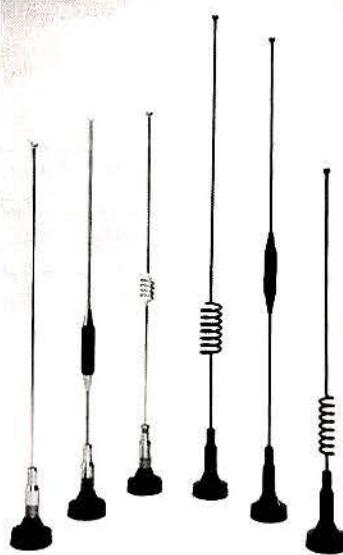
New!

Classic Series

UHF/VHF Antennas

- Rugged Design
- Spring Loaded Contact
- Premium Quality
- Made in the USA

Call For
Free Product
Data Book



1-800-634-4622

Quality Products Made in the USA since 1978
Comtelco Industries, Inc.

501 Mitchell Rd., Glendale Hts., Illinois 60139

Circle (62) on Fast Fact Card

HOT AIR TOOLS

ESD SAFE
de-soldering and
soldering with the leister
labor 'S' HOT AIR TOOL



TRAINING VIDEO AVAILABLE

Electronic Temperature Adjustment from:
68°-1202° F. Air volume adjustment from:
0-150 litres per minute.

For soldering and de-soldering of all SMD and thru hole components.

OVER 500 NOZZLES AVAILABLE



ASK FOR FREE BROCHURE MQ276

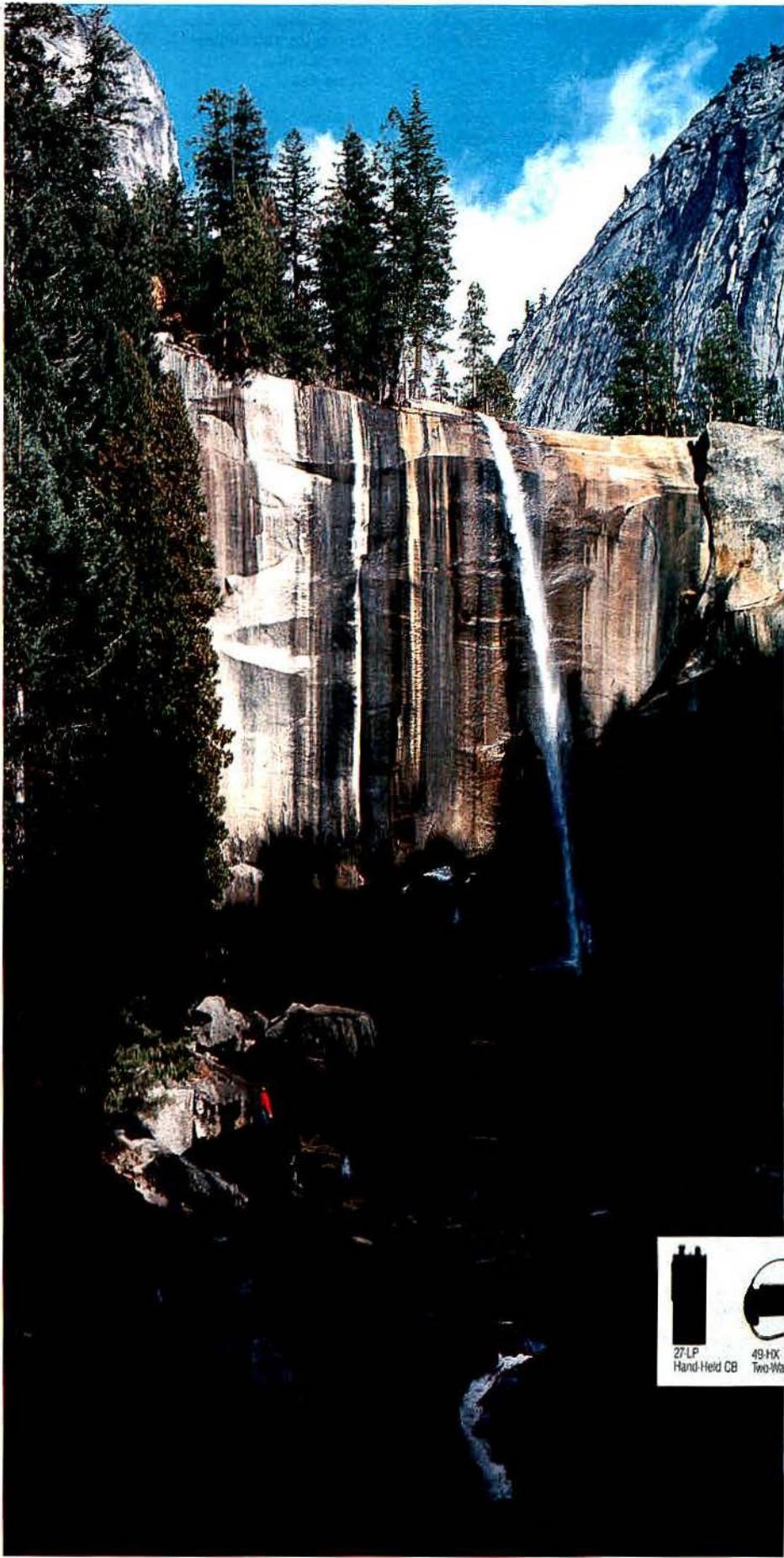
B **W** brian r. white co., inc.

313 HENRY STATION ROAD
UKIAH, CA 95482 (707) 462-9795
FARMINGDALE, NJ 07727 (908) 938-2700

DISTRIBUTOR INQUIRIES WELCOMED

Circle (63) on Fast Fact Card

Stay In Touch.



It feels right. No deadlines, no worries. Just a streamlined way to go with the flow.

Nothing like a strong connection. Nothing like a good call. Nothing like Maxon.

This year, Maxon Systems, Inc. clears new channels for electronics retailers. With the Maxon 49 MHz two-way radios and hand-held CBs. Priced starting at under \$40. Earning

27-SP Hand-Held CB
49-SX Two-Way Radio

high marks and high margins in outdoor, sporting and industrial applications.

Better still, Maxon, recognized for years as a leading manufacturer, now takes the lead in product promotion. With national print advertising support. Tailored merchandiser incentive programs. And an eye on innovative technologies that'll make Maxon . . . a good call for years to come.

Maxon offers a full line of quality electronics equipment including radar detectors, auto alarms and weather radios. Call 800/922-9083.



27-LP
Hand-Held CB
49-HX
Two-Way Radio

PAA-1
Auto Alarm

WX-3
Weather Radio

Series 10
Radar Detector

Series 2000
Radar Detector

maxon®
SYSTEMS INCORPORATED

A Clear Signal For Tomorrow.™



©1991, Maxon Systems, Inc.

U.S. Telecom Booth 830*Existing products*

"Notifier" automatic PC-based, call-down system with bulletin board, voice mail, call transfer and remote control.

Circle 318

Valmont Industries Booth 929*Existing products*

Communications poles and towers; monopoles to 250'; free-standing to 400'; guyed towers to 1,000'.
Circle 319

Vega, Signaling Products Group Booth 1225*Existing products*

C-5110 10-line, four-frequency tone remote control console; DCA-3 three-line dc adapter for C-5110 console; C-534 three-line dc-remote control console.

New products

C-5112 10-line, four-frequency control console with individual volume controls and instant PTT switches for each line, plus panel modules such as 16-button DTMF encoder, two-tone sequential encoder/pad/display, five-tone sequential encoder/pad/display, audio-level display, 12/24-hour clock.

Circle 320

See ad page 1

Whelen Engineering Booths 331, 333*Existing products*

Vehicular warning lights and sirens; high-power

voice and siren warning systems.

Circle 321

Yaesu U.S.A. Booths 322, 324, 423, 425*Existing products*

FTH-2070 dualband hand-held series; FTH-2009/7009 six-channel hand-held series; rugged FTH-2008/7008 hand-held series; Vertex mobiles.

New products

Vertex series featuring four-, 12/24- and 99-channel version mobiles.

Circle 322

See ad on IBC

Zetron Booths 728, 730*Existing products*

Fire station alerting system; ALI instant recall recorder; communication control systems; dispatch consoles; alarm monitor and control system; remote control and alarm monitoring; radio dispatch switch.

New products

CRT console; remote control and alarm monitoring.

Circle 323

See ad pages 71, 87

New products

Remote comparator displays; SC-2000 remote siren controllers.

Circle 324

Communications Associates Booths 315, 317*Existing products*

Distributor of GE two-way radios; antennas and radio accessories; test equipment; cellular telephones and accessories; and other mobile communications products.

New products

GE MPI-II and PCS scan portable radios.

Circle 325

See ad page 83

Kyodo West Booth 1434*Existing products*

KGI09 VHF and UHF portables; KGI05 lowband, highband and UHF mobiles; KGI06 VHF and UHF transportable repeaters; KGI10 VHF and UHF repeater and base stations.

New products

KGI06 transportable and vehicular repeater VHF, UHF or crossband.

Circle 326

See ad page 29

Magnasync Booths 629, 631*Existing products*

Specialist Plus logging recorder; DRP-500.

New products

Digital voice logging recorder.

Circle 327

See ad page 78

Late entries

Combined Technologies Booth 1308*Existing products*

Smartswitch II controllers.

The Industry Standard Just Got Better!

Say Goodbye to Rust, Poor Continuity and Dissimilar Metals Interaction.

**A Better Product at A Better Price!**

- All brass base and locking nut
- Quality Belden® cable
- Shield lug is neatly soldered to base
- Various cable and connector options available

100% Approach to Quality Control

Each mount is continuity and resistance checked and then pre-assembled to test threading fit and function prior to shipment. No loose or missing parts.

1-800-323-3757

O.E.M. and Distributor Programs

Don Cislo presents ...

ANTENEX™
INC.

Signal Propagation Systems

615 C Wheat Lane
Wood Dale, Illinois 60191
Local: 708/616-1138
Fax: 708/616-1118

Circle (65) on Fast Fact Card

Battery Solution

New!



The Cadex C4000 Programmable Battery Analyzer

- Fully rejuvenates weak NiCd batteries
- Simple, automatic operation; quick and reliable
- Universal base unit accepts interchangeable adapters
- Field reprogrammable in seconds with self-prompts menu

CADEX

Specializing in battery maintenance systems

CADEX ELECTRONICS INC.

3111 Thunderbird Crescent,
Burnaby B.C., Canada V5A 3G1
Phone: (604) 421-0061
Fax: (604) 421-0899
Toll Free: 1-800 565-5228 (U.S.)

Circle (66) on Fast Fact Card

Big in Features, Small in Price, Sized Just Right

ZETRON'S COMMUNICATIONS CONTROL SYSTEM

Big in Value

You simply get more for your money. More features, more capacity, and better service -- all for less money.

Big in Quality

With Zetron, quality begins with good design, continues with top performance, and remains with excellent service. We'll be there when you need us.



Big in Features

Zetron's Series 4000 Communications Control System is a multi-channel, multi-position radio control console that features:

- user-friendly, easy-to-use controls
 - central control "switch" with plug-in options
 - 1 to 24 radio/audio channels
 - 1 to 8 desktop, rackmount, and/or CRT console positions
 - full function DC, Tone, Local, and E&M channel control
 - field programmable channel configurations
 - field programmable button functions
 - Automatic Number Identification
 - LTR® remote control (LTR® trademark of E.F. Johnson.)
 - self-diagnostics
 - radio management statistics
 - compact, easy to install
 - shared radio/telephone headset interface
- wide range of mic/headset interfaces
 - big selection of companion products:
 - Programmable Paging Encoders
 - Multi-Format Encoders
 - Instant Recall Recorders
 - E911 Instant Recall Recorders
 - Fire Station Alerting Systems

Sized and Priced Just Right

Zetron specializes in distributed processing and modular hardware, so the cost of a small or medium-sized system can be really quite low. Because you don't pay for the "overhead" of a huge system, you can out-right buy Zetron equipment for the same money you'd spend on the "downpayment" of comparable equipment.

For more information, call, fax, or write
Zetron's Public Safety Division.

ZETRON

12335 134th Ct. N.E. Redmond WA 98052
Phone: (206) 820-6363 Fax: (206) 820-7031

How to share frequencies for private carrier paging

Sharing RF equipment offers the best way to eliminate interference, ensure the fastest processing of paging messages and boost channel efficiency to its highest level. Cooperation among carriers is essential.

By Kevin O'Brien

It is no secret that private carrier paging (PCP) system operators have preferred 152.480MHz as an operating frequency because, until recently, it was the only VHF highband frequency with a power limit as high as 350W transmitter output.

Many believe VHF highband frequencies offer superior propagation, though that may not be so in every situation. But VHF highband commonly is believed to be superior and because VHF highband equipment tends to cost less, a disproportionately heavy use of VHF highband among PCP operators has resulted.

The FCC has raised the power limit on 157.740MHz from 75W power output to 350W power output, so that channel's popularity will increase.

Sharing—no way around it

PCP operators use shared, rather than exclusive, frequencies. Thus, although the FCC has yet to define exactly what "sharing" means, it is inevitable that competing PCP licensees will find themselves together on the popular frequencies. Such sharing can result in conflicts.

• *Fair competition*—Some conflicts result in radio signal interference among competing systems, even though the interference is incidental, rather than intentional. Some competitors grow to dislike each other personally. Emotions

Interference control methods

- *Monitor receiver*—A relay activated by the reception of an RF carrier on a receiver tuned to monitor the PCP channel inhibits the transmitter when any other system is on the air.
- *Interconnected external busy ports*—All terminals used by systems sharing the channel are connected so when one terminal is sending messages, the others are inhibited from sending theirs at the same time.
- *Interconnected external busy ports plus a timing circuit*—A timing circuit on each paging terminal ensures an equitable sharing of transmitter time among systems sharing the channel.
- *Shared RF equipment*—All system operators on a channel share common transmitting equipment. Their terminals are connected via Telocator network paging protocol (TNPP) to process paging messages from all systems in batches.

may stand in the way of using technical means to eliminate interference.

• *Unfair competition*—Other conflicts apparently result from willful interference caused by one PCP system operator to another. An operator with superior RF transmission capability might try to override a competitor's weaker system. An operator who has redundant paging capability, such as a separate radio common carrier paging system, might choose to transmit duplicate paging traffic on a PCP channel to cause trouble for a competitor.

No technical solutions to these types of interference situations are likely to succeed before cooperation, however begrudgingly, begins.

FCC requirement

The terms of licenses the FCC issues to PCP system operators place an obligation upon them: They must not cause interference. It does not matter which system was on the air first. The obligation for each system operator not to cause interference stays the same regardless of how many other systems are active on the frequency. Being "first" to build a system on the frequency carries no priority whatsoever.

Technical solutions

Four methods may be used to configure PCP systems that share a channel so they do not interfere with one another. From the least effective to the most effective, they are the monitor receiver; interconnected busy ports; interconnected busy ports plus a timing circuit; and shared RF equipment.

• *Monitor receiver*—Many PCP system operators who use the first method place a monitor receiver at the system

O'Brien is president of O'Brien Communications, Annandale, VA.

Aerotron Delivers



It can happen anytime.

You arrive at the scene of an accident that requires an immediate call for help. As someone responsible for public safety, the last thing you need to worry about is the dependability of your mobile radio system. That link to additional aid could mean the difference between life and death.

At Aerotron, we know that link is critical.

Every time.

That's why dependability is the prime feature of every mobile radio we produce. We make certain that when you need us, we clearly respond.

Our renewed commitment to reliability is demonstrated by our new 2-year warranty on everything we sell.

Aerotron makes sure that in a crisis situation, communication doesn't become part of the crisis.

Daily.

 AEROTRON

P O Box 27500 • Raleigh, NC 27611 USA • (919) 872-4400 Fax (919) 872-8751

Circle (68) on Fast Fact Card

control point. The receiver is tuned to the system's operating frequency.

When the monitor receives an RF carrier, it closes a carrier-operated relay connected to the paging terminal's "external busy port." When the busy port connection is closed, the terminal is inhibited from sending paging messages.

The terminal holds its paging messages in a queue until the received car-

rier drops. When it does, the relay opens. If the terminal has paging messages to send, it activates the transmitter and sends them, normally in a batch.

The drawback is that more than one system on the frequency that uses monitor receivers may be accumulating paging messages. When the carrier drops, more than one paging terminal may activate. When two or more transmitters

activate simultaneously, the resulting radio interference may cause some or all of the paging messages to fail to reach the intended pagers.

Systems with monitor receivers are in compliance with the FCC rules. As far as anyone knows, the frequency is clear at the moment the terminal activates. But many subscribers may not receive their paging messages. The interference may occur more than a few times per hour, as it would with systems that serve 3,000 to 6,000 subscribers. During the busy hour, those systems are highly ac-

DEALERS WANTED 50-55% PROFIT MARGIN

World's Most PROFITABLE Two-Way Radios

"PRIVATE LABEL PROGRAM AVAILABLE"

Eclipse

PALM SIZED

5 WATT
4 CHANNEL

\$14900



Space Age Technology and Reliability, Top Quality Engineering, Rugged All Weather Construction

Price Includes:

6" Antenna, Wall Charger, Battery, Soft Case, Belt-Clip, One Operating Frequency Installed

SynTronix

SYNTHESIZED

5 WATT
8 CHANNEL

\$18900

Our State-of-the-Art synthesized design makes extensive use of surface mount technology to reduce the size of components and eliminate excessive heat build-up. This combination produces a radio with extremely high frequency capability and minimal deviation characteristics.

Price Includes:

Hi-Low Power Switch, 6" Antenna, Soft Case, Wall Charger, Wrist Strap and 500 MAH Slide-Off Battery.



A ADVANCED VIDEOTECH CORP.

1840 COUNTY LINE ROAD • HUNTINGDON VALLEY, PA 19006
TOLL FREE 1-800-233-0013 • IN PA (215) 322-4600 • FAX (215) 322-4606

Circle (69) on Fast Fact Card

WAITING FOR A BETTER BEEPER BUY?

IT'S HERE!

INTRODUCING THE NEW SAMSUNG VIBRATING NUMERIC DISPLAY PAGER

- POCSAG Format
- 10 Message Memory
- 12 Digit Display

- Domestic Repair Facilities, Warranty and Service Maintenance by MINILEC SERVICES INC.
- Very Competitively Priced

Samples are available **NOW** and exclusively from

BEEPERS TO GO

1129 Northern Blvd./Manhasset, NY 11030
Call 516-365-2337 Ext. 5231 • FAX: 516-365-6050
Ask for Kenneth Hills



Circle (70) on Fast Fact Card

Monitor receivers do not entirely eliminate interference. On most occasions, customers will be dissatisfied.

tive, constantly keying up and down. With heavy loading, the statistical probability of two or more monitor receiver-controlled transmitters activating simultaneously is quite high.

One advantage of the monitor receiver method: It requires no direct cooperation among competitors. One competitor installs a monitor receiver, so does the next, and so on—no discussion is required.

Unfortunately, the results are poor. Monitor receivers do not entirely eliminate interference. On most occasions, customers will be dissatisfied.

The interference is worse with voice traffic because the message is longer—about eight to 14 seconds long. In areas where two or more received signals are at roughly equal strength, the pager squelch will open, and two combined voices will be heard.

With digital traffic, because of the short burst of information—about half-second—the probability of interference is somewhat lower.

- **Interconnected external busy ports**—One step up from the monitor receiver method is to interconnect the external busy ports on all the terminals at all the systems sharing the channel in the area. Leased telephone lines offer a simple method of interconnection.

THREE DIFFERENT MICS. THE SAME EXACTING SHURE STANDARDS.

If you're looking for a high-quality mic with the features you need at a price you can afford, Shure has the answer. Three mics designed to fit the needs and budgets of practically any user and built tough to give you the reliability you've come to expect from Shure.

885TT DTMF - QUALITY THAT'S AFFORDABLE. The 885TT gives you an unbeatable combination of economy, dependability, audio quality, and ease of use. It's a continuous-tone DTMF microphone that sets new standards for value and performance.

Features include:

- Illuminated keypad – designed to last and requiring no extra wiring in most cases.
- Million-Cycle Leaf Switch™ – a Shure exclusive, giving you longer trouble-free use.
- Positive tactile feel keys and audible tone to help make number entry easy and accurate.
- Externally adjustable audio and DTMF levels for easy installation.
- Tailored frequency response and Top-Talk Sound Channels™ provide optimum clarity and intelligibility.

890TT DTMF - THE PROGRAMMABLE CHOICE. The 890TT is a burst-mode DTMF microphone with all the features of the 885TT, plus programmable functions, including:

- Auto-dial feature with ten memory locations (up to 16 digits each).
- Last number redial.
- Lithium battery keeps the programmed memory safe for years.

590T - A DYNAMIC PERFORMER. The 590T, featuring a Shure amplified dynamic cartridge, is ideally suited to a wide range of mobile installations. Tailored frequency response provides optimum voice articulation while it discriminates against other sounds. The 590T is a workhorse designed to provide trouble-free service under the harshest conditions.

ALL FEATURE THE SPEED, VERSATILITY AND COST-SAVINGS OF MODULINK™ TECHNOLOGY. All three mics are part of Shure's patented ModuLink System 1. Modular cordsets allow these mics to plug instantly into virtually all of the most widely used radio transceivers with no hardwiring – making installations and cable replacement, literally, a snap. Replaceable cordsets also help reduce inventory and lower repair costs.

THE FINAL WORD ABOUT QUALITY. At Shure commitment to quality is not simply talk. You'll be able to see and feel the quality of our mics as soon as you pick one up. Because we test them tougher, our mics last longer and perform better.

CALL 1-800-257-4873. We'll rush you a free catalog explaining, in detail, all the features and benefits of Shure Communication mics and a complete radio compatibility chart.



SHURE®

THE SOUND OF THE PROFESSIONALS® . . . WORLDWIDE

Circle (71) on Fast Fact Card

NOW
ModuLink™
microphones plug
instantly into
**SYNTOR X9000,
SPECTRA, MARATRAC,
TMX8825 and FMD,**
plus nearly every
other popular radio
transceiver.

When one terminal is sending paging messages, all other terminals are inhibited from sending pages; and their transmitters remain silent. The possibility of more than one transmitter activating when one terminal finishes sending messages remains. But the probability is greatly reduced because the delay associated with the operation of monitor receivers is eliminated.

• *Interconnected external busy ports plus a timing circuit*—The next step is to add a timing circuit to each paging terminal so it is limited to a finite amount of airtime for each transmitter activation. When one terminal has sent 100 seconds worth of messages, for example, it releases the channel for 100 seconds to another system that shares the channel.

The systems alternate channel use indefinitely or until they have exhausted their queue of messages. The arrangement works until the cooperating systems are loaded to the point where the timing interval is not long enough for a batch. System operators are reluctant

to use an interval much longer than 100 seconds because their customers may not want to make wait that long for their messages to be sent.

The ultimate arrangement is shared RF equipment use.

as 1,000 units. Voice traffic is not time-, spectrum- or money-efficient.

• *Shared RF equipment*—The ultimate arrangement is shared RF equipment use. All system operators on a channel share the same transmitter(s). They interconnect their paging terminals via the Telocator network paging protocol (TNPP). (See "Networking Protocol Links Voice Paging Systems," May 1989 issue.)

If 10 transmitters are required to cover the service area, the system operators share 10 transmitters jointly, instead of building 10 transmitters each. The arrangement eliminates RF redundancy and eliminates interference.

TNPP allows all the messages on the shared system to be batch processed, making the system more efficient and increasing the channel capacity.

Exponential interference

Problems resulting from interference among systems rise exponentially with the number of systems on a channel. For example, four co-channel licensees

There's "No Visible Microphone" on This VOX Headset!

Secured inside the soft, durable earmuff, the NVM contact microphone provides excellent clarity and noise cancellation. EARMARK's VOXSET with NVM is adaptable to most portable radios. Ideal for hands-free operations in high noise, with Self Contained Breathing Apparatus or under protective clothing. Built for durability in harsh environments! Rated as Intrinsically Safe by Underwriters Laboratories. Call EARMARK for a free demonstration.



 **EARMARK®**
1125 Dixwell Ave., Hamden, CT 06514 USA
Telephone (203) 777-2130
FAX (203) 777-2886

NSV1

Circle (72) on Fast Fact Card

76 Mobile Radio Technology August 1991



**A
Winning
Combination
Decibel Products Quality
Primus Electronics Service**

primus 
ELECTRONICS CORPORATION
800-435-1636 IL 800-892-1413
FAX 800-767-7605

Circle (73) on Fast Fact Card

EVER WISH YOUR EQUIPMENT WOULD **CALL YOU** BEFORE IT **FAILS?**

*If It's Monitored By **ProTek** – It Will!*

Any equipment (including pumps, generators, transmitters receivers, repeaters and system controllers of all types) can be monitored by **ProTek**. In addition, key site conditions such as **tower lights, AC power, intrusion alarms, smoke detectors** and others can be monitored. **ProTek's** built-in relay outputs can be used to automatically control equipment at the site.

Unique programmability allows the user to create a sophisticated closed loop control system capable of automatic alarming. **ProTek's** inputs accept contact closures and DC voltages. The user defines input limits, time delays, qualifiers and relay outputs to be controlled. Any active input can be programmed to place an alarm call.

An integral modem and speech synthesizer allow **ProTek** to alert you to inputs out of limits by calling a person, pager or computer (up to 8 phone numbers in any combination). You can call **ProTek** from any tone telephone and it will tell you the actual value of any input (in volts, watts or high/low level). Using the telephone, you can control all relay outputs and listen to audio inputs.



ProTek is field-expandable – up to 129 inputs.
ProTekjr has 14 inputs and 8 outputs.

Time-stamped event recording (stored in non-volatile memory) helps pin-point intermittent problems. Best of all, no special computer software is required to program the unit – any Video Display Terminal can be used since all user-friendly screen software is resident in **ProTek**.

To find out more about the **ProTek** family of Monitor, Alert and Control Systems, give us a call at (919) 876-8294 or FAX (919) 876-5666.

PAGE~~T~~EK

The Monitoring and Control Experts
2801 Spring Forest Road
Raleigh, NC 27604

operating independent systems with monitor receivers do not generate legitimate paging traffic. What they generate is interference to one another. Occasionally a paging message gets through. But the customers will not stand for it. That kind of trouble puts PCP system operators out of business.

The key to sharing a channel is a proper system design that considers:

- the coverage area you need.
- co-channel licensees and where their sites are located.
- the type of equipment the co-channel licensees use.
- how much airtime the co-channel licensees currently use.

Some information about the co-channel licensees may be difficult to obtain without their cooperation. Nevertheless, an FCC license carries with it the obligation not to cause interference. The best solutions require communication and cooperation among co-channel licensees, and there has to be cooperation among the licensees.

Licensees who are not comfortable

communicating directly with their competitors may want to ask a third party, such as their system engineers, to help. Sometimes the system engineers and engineering consultants can communicate

worth hundreds of thousands of dollars is installed, it is important to set the stage for cooperation to prevent interference. Once the equipment is installed, correcting an interference problem—if it can be corrected—may cost thousands of dollars more.

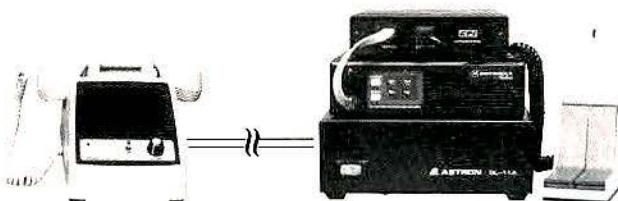
Cooperation

The key to high-quality, efficient and profitable PCP systems is cooperation among all licensees. If you operate a PCP system and a new, co-channel system becomes licensed in your area, do not bemoan your fate immediately. Make an effort to work with your new co-channel neighbor from the beginning, to ensure an interference-free environment.

If you are the new licensee who will be activating a new system in an area where one or more co-channel systems already operate, begin discussions with your co-channel neighbors early on. The ability to deliver high-quality service to your customers will be worth the effort.

NEED TO REMOTE A RADIUS?

CPI COMMUNICATIONS MR Series termination panels provide a **QUICK** and **SIMPLE** interface of D.C. and Tone remote controls to various Motorola conventional and trunking mobiles.



- SIMPLE MODULAR PLUG CONNECTIONS
- REMOTE AND/OR LOCAL OPERATION
- PROVIDES PTT AND MONITOR FUNCTIONS
- NO RADIO MODIFICATION REQUIRED
- SEPARATE ADJUSTABLE TX & RX AUDIO AMPLIFICATION
- PL-DPL COMPATIBLE
- B308 OPTION NOT REQUIRED



COMMUNICATIONS, INC. TEL 214-437-5320
505 NORTH BOWSER WATS 800-869-9128 USA
RICHARDSON, TEXAS 75081 FAX 214-437-5360

*PL-DPL, Motorola and Radius are trademarks of Motorola Inc.

Circle (75) on Fast Fact Card

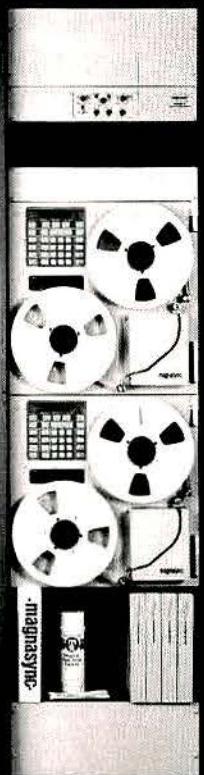
REDUNDANCY THE RELIABILITY SPECIALIST RESPONSE PLUS

Featuring:

- 100% REDUNDANCY
- UNPRECEDENTED FLEXIBILITY
- COMPLETE MICROPROCESSOR CONTROL
- UNPRECEDENTED RELIABILITY
- UNPRECEDENTED REMOTE CAPABILITIES
- AUDIO VOICE SEARCH
- ACTIVITY STATUS/MONITOR
- CASSETTE COMPILER/TALKING CLOCK
- BUILT-IN DIAGNOSTICS
- LOW MAINTENANCE

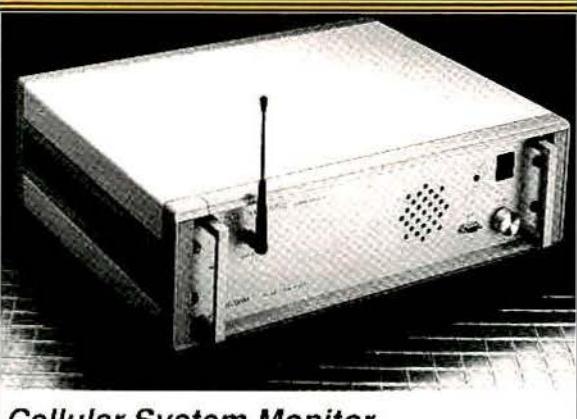


1135 Mansfield Avenue Hollywood, California 90038
Telephone: 213/962-0382
800/366-3564



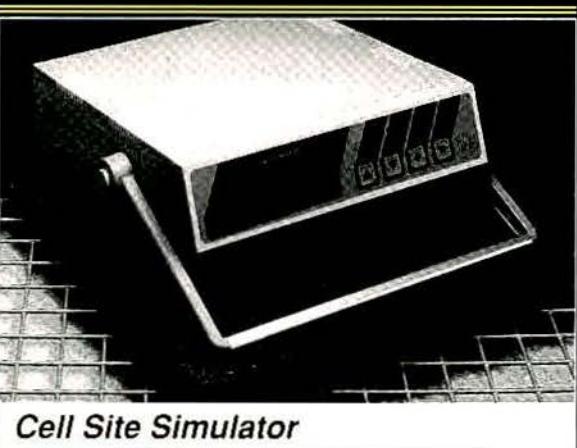
Circle (76) on Fast Fact Card

IMPROVE YOUR PERFORMANCE



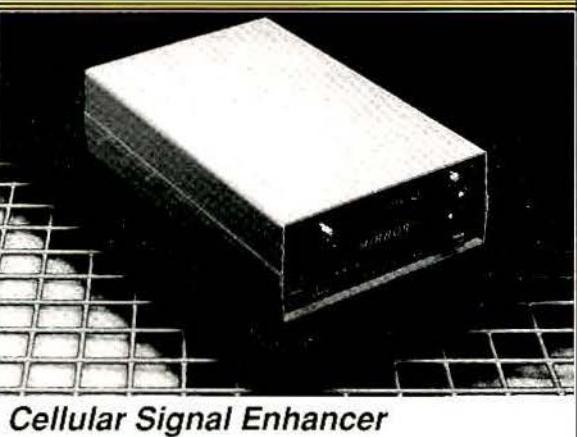
Cellular System Monitor

Improve your overall system performance with the automatic, "off air," CSM-8000 monitoring system. Select mode for monitoring and recording Cell Site RF equipment with the CSMU (Cell Site Monitoring Unit), or for passing mobiles with the MMU (Mobile Monitoring Unit). CSMU transmits measurements including TX Carrier Error, SAT Frequency and Deviation, Peak Voice and Power Levels. This information is pulled from transmitted RF rather than Baseband, a great advantage. Information obtained by MMU includes MIN, MAC, SAT and ST Frequency and Deviation, Peak Voice Deviation and Carrier Frequency Error. Recorded data rate is approximately one mobile every thirty seconds. Data recorded may be transferred to a personal computer via a modem to build statistical records. Reduce your down time by identifying problems early!



Cell Site Simulator

The ART-875 is a dedicated Cellular Test instrument of the highest standards. The Cell Site Simulator gives you the ability to evaluate the performance of your cellular telephones by accurately measuring Carrier Frequency, Power, Modulation and Audio Frequencies. Testing on Channels 666 and 832, Wireline or Nonwireline. This unit is completely portable with RS232 port for printouts. This unit has received Carrier acceptance.



Cellular Signal Enhancer

Expand your cellular coverage in signal blocked areas. The MIRROR™ is a compact cellular enhancer and signal booster for all your small area coverage needs; agents, dealers, homes and conference halls, to name a few. Small, light-weight and easy to install, the MIRROR™ increases your coverage at a truly affordable cost.

Please stop by our Booth #1348 at
the IMCE Expo in Anaheim
March 26-28, 1991



**Smith Myers
Communications USA**

4101 Green Oaks Blvd. West, Suite 205, Arlington, Texas 76016
Phone: (800) 642-9512 / (817) 483-9047 Fax: (817) 483-8482

Call for representative nearest you.

Paging industry nets 10 million subscribers

The paging industry boasts more than 10 million subscribers, according to a report released by Telocator, a Washington, DC, trade association representing paging and cellular interests. The report was conducted on Telocator's behalf by EMCI.

The report lists 1989 subscribers at 8.1 million, growing to 9.9 million at the

end of 1990. Early in 1991, the numbers of subscribers has surpassed 10 million. The 1990 increase of 1.8 million represents a 22% growth rate.

Since cellular's debut, paging has grown from 2.2 million to more than 10 million, which indicated paging is complementary to cellular, the association said.

Antenna Specialists increases warranty

Antenna Specialists, Cleveland, has increased its Gold Seal Warranty to two years on land mobile and cellular base station antennas. The company has more than doubled the amount of replacement labor reimbursement, as well. The Gold Seal Warranty applies to all properly registered ASP base station antennas displayed with the Gold Seal emblem in a current catalog. The enhanced warranty became effective April 1.

Vegas Instant Page acquires carrier

Vegas Instant Page, Las Vegas, has acquired Mr. Beeper's paging company, Las Vegas. Terms of the deal were not disclosed.

Vegas Instant Page serves Las Vegas, Boulder City, Henderson and Laughlin in Nevada. The company plans to have channel-sharing agreements with out-of-market providers that will extend coverage in Nevada to Barstow, Reno and Lake Tahoe.

Coded reaps pilot orders for mobile data modem

Coded Communications, Carlsbad, CA, has received four pilot orders for its IQmodem from public safety operations. The orders are from the Los Angeles County Fire Department, City of Phoenix Fire Department, City of Dallas Fire Department and the San Bernardino County Sheriff Department.

The use of the IQmodem and software will permit these agencies to use laptop computers and mobile data terminals.

Johnson sells SMR network switches

E. F. Johnson, Minneapolis, has sold two AmeriCom network switches to:

- Summit City Radio, Ft. Wayne, IN.
- A & B Electronics, Hobbs, NM.

The network switch enables wide-area networking, including interconnect and over-the-air programming. The switch sold to A & B Electronics is the second one sold to the operator.



HIGH PERFORMANCE PRESELECTOR-PREAMP

The solution to most interference, intermod, and desense problems in repeater systems.



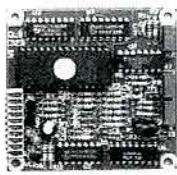
- 40 to 1000 Mhz tuned to your frequency
- 5 large helical resonators
- Very high rejection
- Low noise—high overload resistance
- 8 db gain—ultimate rejection >80 db
- GaAs fet option (above 200 Mhz)
- Cast aluminum enclosure
- N, BNC, and SO239 connector options

Typical rejection:

±600Khz @ 145 Mhz: 28db	±20 Mhz @ 800 Mhz: 65db
±1.6 Mhz @ 220 Mhz: 40db (44db GaAs)	±20 Mhz @ 950 Mhz: 70db
± 5 Mhz @ 450 Mhz: 50db (60db GaAs)	

AUTOMATIC IDENTIFIERS

- Up to 8 EPROM programmed messages
- Adjustable audio, speed & interval timer
- "ID over voice inhibit"
- Low power option
- Modular design
- Message selection via binary input—TTL levels
- Size: 2.7 x 2.6 x 0.7"



Model
ID-2B

The ID-2B provides required station identification without troublesome diode programming. The "ID over voice inhibit" circuitry allows for courteous operation by not allowing an ID until the next squelch closing.

ID-2B Wired/Tested \$99.95

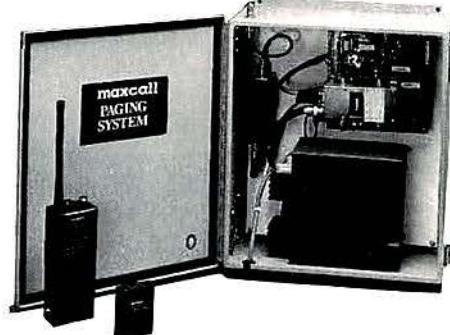
ID-2B-LP Low Power \$109.95

GLB ELECTRONICS, INC.

151 Commerce Pkwy., Buffalo, NY 14224
716-675-6740 9 to 4

Circle (78) on Fast Fact Card

ON-SITE PAGING POWER



25 Watts of power for about the same price as other lower power systems. That's the **maxcall** advantage... So, why take a chance on a 2, 4 or 5 watt system being able to meet your needs?

UHF or VHF, a mix of digital and analog paging in a single compact unit with power levels of 2, 5, 25 or 100 watts.

Call today
for more
information!

© 1991 - Maxon Paging Products

maxon

PAGING PRODUCTS

10828 NW Air World Drive
Kansas City, MO 64153

816-891-6320

FAX 816-891-8815

TLX 153252506 MAXONKC

Circle (79) on Fast Fact Card

BREAKING UP IS HARD TO DO.



Larsen Antennas Come Through Loud And Clear.

Those whose lives and livelihood depend on clear communication, depend on Larsen antennas. Law enforcement officers. Fire fighters. Construction crews. Oil explorers. The list is endless. So are the advantages.

Larsen antennas communicate further and more efficiently. Our exclusive Külrod® stainless steel whips turn maximum power into clear communication, not resistance heating. The whip increases flexibility and minimizes radiation pattern distortion. The result is a clear, constant signal.

More than 25 years of industry leadership go into every one of our products. Over 800 in all. Each with a specific use. And all backed by our No Nonsense one year warranty.

In the U.S.A., call 1-800-426-1656 or 206-944-7551.

In Canada, call 1-800-663-6734 or 604-872-8517.

It'll be the beginning of a beautiful and profitable relationship.



Larsen® Antennas

Larsen® and Külrod® are registered trademarks of Larsen Electronics, Inc., U.S.A.

Circle (80) on Fast Fact Card

Turney ends five years on volunteer leadership council

Donald Turney, a Motorola field technical representative, has concluded five years as a member of the Association of Communications Technicians (ACT) volunteer leadership council. ACT is a membership section of the National Association of Business and Educational Radio (NABER).

Asked what attracted him to ACT in the first place, Turney said: "I was involved early on with the certification program. I see the two as being very close. Although you can have one without the other, ACT and technical certification complement one another."

"I wanted to join the ACT council to make sure it was aimed at the working technician and that it would be for the working technician. I see ACT as the IEEE for the working technician. It is our professional society, recognized throughout the industry."

Turney said membership in the association helps technicians to find out what the other professionals are doing

and who they are. "They tend to be isolated, but ACT helps them to see things from a larger perspective."

"Beyond that," he said, "the association tries to help the technician who wants to start his own business. It offers the technician information to help him in these new ventures, such as technical training and how to deal with customers."

Turney said his experience on the council showed him something about association financial matters. "I see that anything you do costs money. The average working technician doesn't make a lot of money relative to many other people in the industry. There is a limit to how much they can be asked to pay in the form of dues. Yet with anything ACT does, somebody has to pay for it. It pretty much comes out of dues money. Right now, the way it is going, dollar for dollar it is a good bargain for the person who joins."

Turney said another reason he joined

the council was to return something to a business that has been good to him. "I'm 60 years old; I've been in the business 40 years. I envision the average new technician as being 25 years old, getting out of the service, having 1.5 children. I want to return to him what the business has done for me. I want to make sure the business does not take advantage of him, and that he is given good counsel. He may see the manager making the money and not realize the manager's job is not an easy one. I hope he will gain insight into these things through the *TechTalk* newsletter and *Business Radio* magazine."

Constant training is essential for today's technicians, Turney said. "At one time, we could be a jack of all trades—RF, data, audio, systems—but that is getting more and more difficult. RF is RF, audio is audio, and now there is data communication equipment that must be serviced.

"Then you have microwave and a lot

IT'S NICE TO FOOL MOTHER NATURE!



SPECIFICATIONS

Attack time	Zero to 10ns, depending on induced waveform
Surge current	0.20 in., 20,000 amps
Operating Temp.	-65 to 125 Celsius
Discharge Inductor	Toroidal, isolates
Back-EMF GDU	600-1000V, ceramic body construction, G.I. Clad
VSWR	Less than 1.1 over rated operating range
Insertion loss	Less than .1db
Impedance	50-75 ohms
Hardware	10-8 stainless hardware
Finish	9-32 stainless steel ground lug, back track 5032-H32 Gage, 6-32 mounting hardware
DC resistance across Capacitive effects	Natural plating
GDU specs	47k to 250k ohms, resistive
Environmental	Less than 1pt
CatV, 75 OHMS	Meets RIA PE-00
Warranty	One year standard

Unlike any other lightning protection device for coaxial transmission lines, I.C.E.'s Model 300 series requires no pre-determined voltage to develop between conductors before voltage suppression begins. Units are constant drain, capacitor-blocked, non-DC passive, and each relies on a heavy discharge inductor paralleled with a ceramic gas-discharge assembly to provide a lightning-fast trap system for induced voltages.

Virtually indestructible, 300 series arrestors are built in 1/8" thick standard chassis enclosures with dual stainless steel mounting/grounding screws.

Over a thousand satisfied customers have chosen from the numerous models & connector choices offered. Each is packed with mounting hardware, storage box, and 4-page owner's manual.

(PATENT APPLIED FOR.)

MasterCard VISA

MODELS, PRICES

HF-VHF (1.5 TO 225 MHz)

MODEL 301 U	300W, SD239s	\$29.95
MODEL 301 N	300W, N CONNS	\$31.95
MODEL 301 B	300W, BNC	\$29.95
MODEL 301 R	300W, RCA PIN	\$29.95
MODEL 303 U	5KWR, SD239s	\$34.95
MODEL 303 N	5KWR, N CONNS	\$36.95
CATV, 75 OHMS	SKWEP, N CONNS	\$26.95

MODEL 310, RCV ONLY, "F" CONNS.

MODELS, PRICES

VHF UHF (30-500MHz)

MODEL 302 U	300W, SD239s	\$29.95
MODEL 302 N	300W, N CONNS	\$31.95
MODEL 302 B	300W, BNC	\$29.95
MODEL 302 R	300W, RCA PIN	\$29.95
MODEL 304 U	5KWR, SD239s	\$34.95
MODEL 304 N	5KWR, N CONNS	\$36.95

TVRO SATELLITE TV

MODEL 315, DC PASSIVE, "F" CONNS.

\$24.95

1-800-ICE-COMM

Order Line
Main Office
Customer Service
Fax (24 hours)
Mail

1-800-423-2600
(317) 545-5312
(317) 547-3306
(317) 545-0645
P.O. Box 18495
Indianapolis, IN 46218

MADE IN THE U.S.A. WHERE MOST OF THE WORLD'S FINEST PRODUCTS ARE DESIGNED AND BUILT.

Circle (81) on Fast Fact Card

PROFESSIONAL VOICE LOGGING RECORDERS

Talking Time Clock repeats time/date on optional Time Track

Fail safe alarms monitor tape movement to prevent operator error

Voice activated recording: 2, 8, or 16 hours of talk time on a standard audio cassette

One button instant review of messages



Select an Omnicron to automatically record your important telephone conversations, two-way radio messages, or dictation. Choose from six models (\$330-\$420) and a full line of accessories.

OMNICRON ELECTRONICS

581 LIBERTY HIGHWAY
P.O. BOX 623
PUTNAM, CT 06260
203 • 928 • 0377

Circle (82) on Fast Fact Card

of things that go along with it: telephony and T-carrier. A young technician almost has to be visionary to see which end of the industry he wants to get into. Another part of the job in choosing a career is the practical side, and that involves training."

Turney said it is up to the manufacturers to train technicians on the individual nuts and bolts of their radios, but technicians must go outside that for the "big picture."

Resources for technicians that he named include colleges and amateur radio. "In amateur radio, a technician can be involved in moonbounce communications, packet radio networks and all sorts of things that provide experience in the broad picture of dealing with low-level signals, packet switching and whatever else you are interested in. It is amazing what you can learn by building your own transmitters and receivers as a radio amateur."

He said that some of the technicians he knows are active on amateur radio packet switched networks. "It is amazing the things they come in and say: 'I ran into this problem and this is how I handled it. You can't just put data into a radio, you have to do this and such.' This type of involvement in amateur radio is excellent training, because now they will apply it to everything they do."

Speaking about the association seeking new members for the volunteer leadership council, Turney said the council should have at least one working technician. "someone who is involved every day using schematics, hand tools and test equipment to track down whatever the problems of the day may be. It is important that the council continues to concentrate on being a professional organization dedicated to meeting the needs of the ACT membership."

Information

For information about ACT and technician certification, call 800-759-0300. Ask for 'technician services.'



The Complete Mobile Communications Distributor

Amphenol®



CENTURION

CELWAVE

Cablewave Systems

cushcraft/Signals



MAXRAD

EORA
ELECTRONICS

RF INDUSTRIES

Your complete antenna, cable, and connector source



**Communications
Associates Inc.**

305 N. Republic Ave. P.O. Box 2399 Joliet, IL 60434

US (800) 435-9313 In Illinois (800) 892-1611

Order Fax (800) 284-4934

Circle (83) on Fast Fact Card

Monitoring, minimum power reduce interference

Monitoring the channel before transmitting and using minimum power are steps two-way radio operators should take to reduce interference, according to David A. Viglione, the engineer-in-charge at the FCC Field Operations Bureau Buffalo, NY, office. The engineer-in-charge said he was expressing his own views and not necessarily those of the FCC.

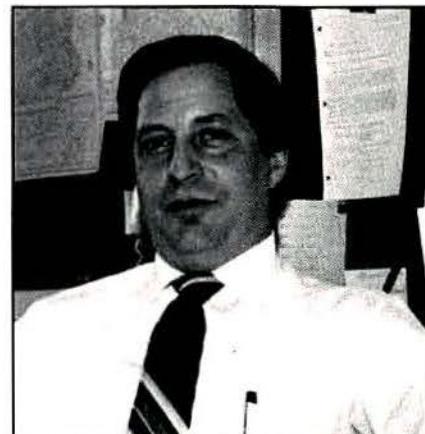
"The most common type of land mobile radio interference complaint handled at this office involves situations in which several repeaters are close enough so their coverage areas overlap," he explained. "When a mobile unit associated with one repeater begins transmitting, it may activate a second or third repeater inadvertently. Using coordinated continuous-tone controlled squelch system (CTCSS) tones to prevent one system's mobiles from activating another system's repeater is part of the solution."

The engineer said system operators must coordinate tone selection among

themselves because FCC rules do not give the commission authority to control tone selection. "Even with CTCSS," he said, "monitoring the channel before transmitting is essential to avoid interference and is required in the rules. For example, one CTCSS-controlled repeater on one tone may be active, yet a mobile operator from another CTCSS-controlled system on another tone would not hear it unless he monitors. If he is close enough to the first repeater to capture its receiver when he transmits, he will interfere with that repeater if he does not monitor the channel and wait until it is clear."

Viglione said a mobile unit cannot hear a co-channel repeater from another system sometimes, although the mobile signal is strong enough for the repeater to pick up. "If he begins transmitting, he may unknowingly cause interference."

Limiting transmitter power to the minimum required to carry out the



David A. Viglione: 'In Canada, they think nothing of assigning a base station 5W, where we might assign a similar station 200W. They say Americans are power-hungry.'

desired communications helps to reduce interference. "Just because your station is authorized for 500W, for example, does not mean you have to use 500W," he said. "In Canada, they think nothing of assigning a base station 5W, where we might assign a similar station 200W. They say Americans are power-hungry."

Comparisons between U.S. and Canadian operations come easily to Viglione because his office is at the border. In fact, a large portion of the work handled at the Buffalo office involves resolving interference problems between U.S. and Canadian stations. Toronto is 65 miles from Buffalo. Most of the radio propagation path is over water, so radio signals pass more freely between the cities than they might if the propagation were over land.

Metropolitan Toronto, with an estimated 4 million population, makes heavier use of the radio spectrum than metropolitan Buffalo, with an estimated 1 million population. "The Buffalo office is the only border office whose neighboring Canadian city is larger than the U.S. city," Viglione said.

When license applications are processed and coordinated, mileage separations are taken into account, but the superior propagation over Lake Ontario may extend coverage beyond expectations. "Certain licenses look good on paper," the engineer-in-charge said, "but when you put the stations into operation, their signals interfere. As a re-



"OUR ANTENNAS PERFORM"

- * A Complete Line of Original Equipment And Replacement Portable Antennas
Motorola, GE, E.F. Johnson, Uniden, RELM, Midland, Bendix King, Ritron, Standard
- * Specializing in Injection Molded Antennas with Built-In Strain Reliefs
- * Specializing in the Public Safety Market
- * VHF, UHF 800-900 Trunking



1-800-368-0078
FAX: (305) 486-9001

Circle (84) on Fast Fact Card

CHECK OUT OUR ANGLES ON 2-WAY RADIOS



PERFORMANCE

No missed calls. Scans 50 channels per second, *an industry record*. Three modes of priority.

VERSATILITY

Up to 210 channels available in VHF and UHF portable models.

FLEXIBILITY

Program from a personal computer or the radio keyboard, or clone radio-to-radio.

DURABILITY

Meets MIL-STD 810 C & D tests for rain, vibration, high & low temperature, dust, humidity *and more*.

RELIABILITY

Works a full day, with *an industry-low* 15 mA standby-mode current drain.

To check out all our angles, call 800-648-0947.

BENDIX/KING

ALL THE RADIO YOU'LL EVER NEED.™

MOBILE COMMUNICATIONS DIVISION • 2920 HASKELL AVE., LAWRENCE, KANSAS 66046 • 800-648-0947 • (913) 842-0402, EXT. 2144 OR 2132 • FAX (913) 841-0287

Regulating technology

sult, we have to resolve a certain number of co-channel, adjacent channel and spurious emission problems."

Viglione said his office has a good relationship with the Canadian Department of Communications (DOC), which regulates radio spectrum in Canada. "We communicate directly with them by telephone."

When the DOC reallocated the 420MHz-to-430MHz band from amateur radio to land mobile radio several years ago, the FCC followed suit in an area defined by the international border with Canada and a line 75 miles south ("line A"). The reallocation offered some relief to land mobile radio system operators in major U.S. cities within that area, including Detroit and Buffalo. "We are just starting to get some interference complaints in that band," Viglione said, "so it apparently is starting to fill up. In this area, the band is populated by some community repeaters, some private repeaters and some local government repeaters. The additional spectrum has helped quite a bit."

Court overrules FCC, grounds mobile satellite

In a March ruling, the U.S. Court of Appeals for the District of Columbia reversed a 1989 FCC decision that granted a mobile satellite service (MSS) license to a consortium, American Mobile Satellite (AMS), Washington, DC. The court ordered the FCC to conduct comparative hearings to process mu-

ally exclusive applications originally filed for the MSS license. AMS president Brian Pemberton said the ruling will not delay his company's introduction of MSS. Other sources indicate the ruling may delay introduction of the service by three to five years.

Automated service offers callers FCC information

The FCC's Licensing Division in Gettysburg, PA, has installed an automated information system in its Consumer Assistance Branch. Telephone callers with Touch-Tone dialing can call 717-337-1212 24 hours a day and use their telephone's push-buttons to select recorded messages from a list of options. Operator assistance is available for callers, including those with rotary-dial telephones, from 8 a.m. to 4:30 p.m. EST, Monday through Friday.

'Beeper bill' would limit drug dealers' pager access

U.S. Reps. Cardiss Collins (D-IL) and Thomas Manton (D-NY) have introduced a bill into the U.S. House of Representatives that would allow law enforcement officers to discontinue mobile communications services to subscribers suspected of drug trafficking. The officers would be responsible for notifying users when their service is terminated, and the bill would relieve carriers from any liability.

SONIC

Sound Technology Working For You

The Sonic Throat Microphone allows hands free communication in high noise, severe environments. Police Special Operations and Fire Hazmat Teams can maintain radio contact under adverse conditions.

CALL OR FAX FOR MORE INFORMATION ON SONIC PRODUCTS

Sonic Communications Inc.
4 Colonial Center Box 287
New Ipswich N.H. 03071 USA
Tel: 603-878 1944
Fax: 603-878 1773



Circle (86) on Fast Fact Card

DO IT THREE WAYS

FIELD PROGRAMABLE AUDIO FIELD PROGRAMABLE CODE



Series 1601 Solid State Voice Storage Unit



Series 1401 Morse Code Station Identifier

or

LET THE FACTORY DO IT FOR YOU



Series 1300 Morse Code Station Identifier

Automatic Transmitter Identification

- Operates on AC or DC power
- Switch set digital timer
- Three monitor inputs available to prevent channel interruption
- Simple interface to most transmitters

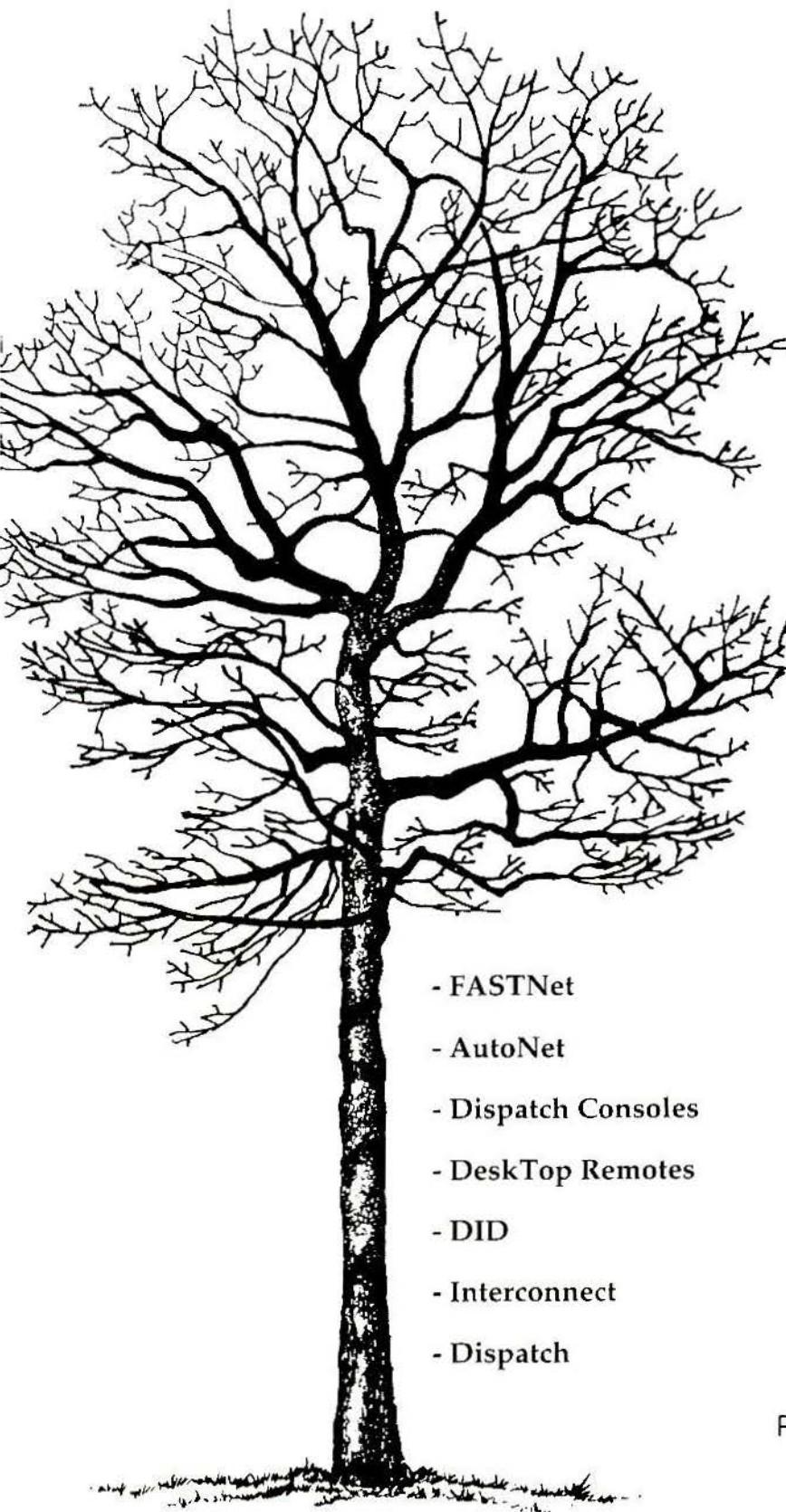
We have built transmitter identifiers since 1962 and our current production models which use the latest in technology, have an established reputation for high reliability throughout the industry. Available through communications suppliers or call us direct.

RACOM
PRODUCTS FOR COMMUNICATION
5504 State Road, Cleveland, Ohio 44134 216-351-1755
TELEX 241424, FAX (216) 661 1040

Available Through
Communications
Suppliers

Circle (87) on Fast Fact Card

When You're Ready to Branch Out,



- FASTNet
- AutoNet
- Dispatch Consoles
- DeskTop Remotes
- DID
- Interconnect
- Dispatch

Zetron's Trunking Systems Grow With You

Don't get stumped when you want to take the next step. With Zetron, you can configure a trunking system with the features and capacity to meet your immediate needs and expand your system as your customer base grows and your services branch out.

From Trunking Repeater Managers and Remote Controllers through Dispatch Consoles and Trunked Radio Networking Switches, Zetron can make your radio trunking system as simple or as sophisticated as you need.

CALL OR WRITE TODAY.

Phone: (206) 820-6363 Fax: (206) 820-7031

ZETRON

Readers' choice

Of all the new products and services in the January issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

GPS receivers suit military, commercial uses

The MX 7100 series rugged, low-power GPS receivers suit cargo tracking, forestry and weapons delivery systems, among other commercial and military uses. The Magnavox six-channel units offer uninterrupted continuous tracking of as many as six satellites. The units support high acceleration rates without signal loss.

Circle (482) on Fast Fact Card

Telephone interconnect sets up easily

The Personal Patch telephone interconnect from **Communications Electronics Specialties** boasts economical price and easy setup. The device operates in sampling or VOX modes for simplex operation. In its half-duplex mode, the unit suits adding interconnect to LPI repeaters.



Circle (492) on Fast Fact Card

Equipment structure comes with carrier for travel

The Speed Space building from **Commercial Structures** is mounted to a double-axle carrier with a ball hitch for transportability. The building can be transported to various locations for use as a monitoring station, as well as other communications uses. The structure

has a ramp access to its door; tail and break light assembly; and running lights. Options include bullet-resistant construction, custom sizes, lights, HVAC system, desks, roof overhangs, windows and a generator.

Circle (461) on Fast Fact Card

Mobile data modem provides error-free communications

The IQmodem from **Coded Communications** uses digital signal processing to provide error-free, 4,800bps data communication in two-way radio applications. The queuing data modem includes digital channel sensing, message buffer memory and forward error-correction protocol. The modem works with existing MDI mobile data systems.

Circle (485) on Fast Fact Card



2,000-channel scanner probes 36 channels per second

The Ace Communications 2,000-channel receiver covers 1MHz to 1,500MHz and scans 36 channels per second. The scanner boasts high speed, broad coverage and a built-in interface to an RS-232 port. The unit is for tabletop or under-the-dash use. The receiver can scan 62 banks of 32 frequencies for 1,984 scanned frequencies, and 16 memory locations are set aside for beginning and ending search limit frequency pairs. The unit slows scan rate to compensate for tuning lags

when adjacent frequencies are more than 30MHz apart.



Circle (483) on Fast Fact Card

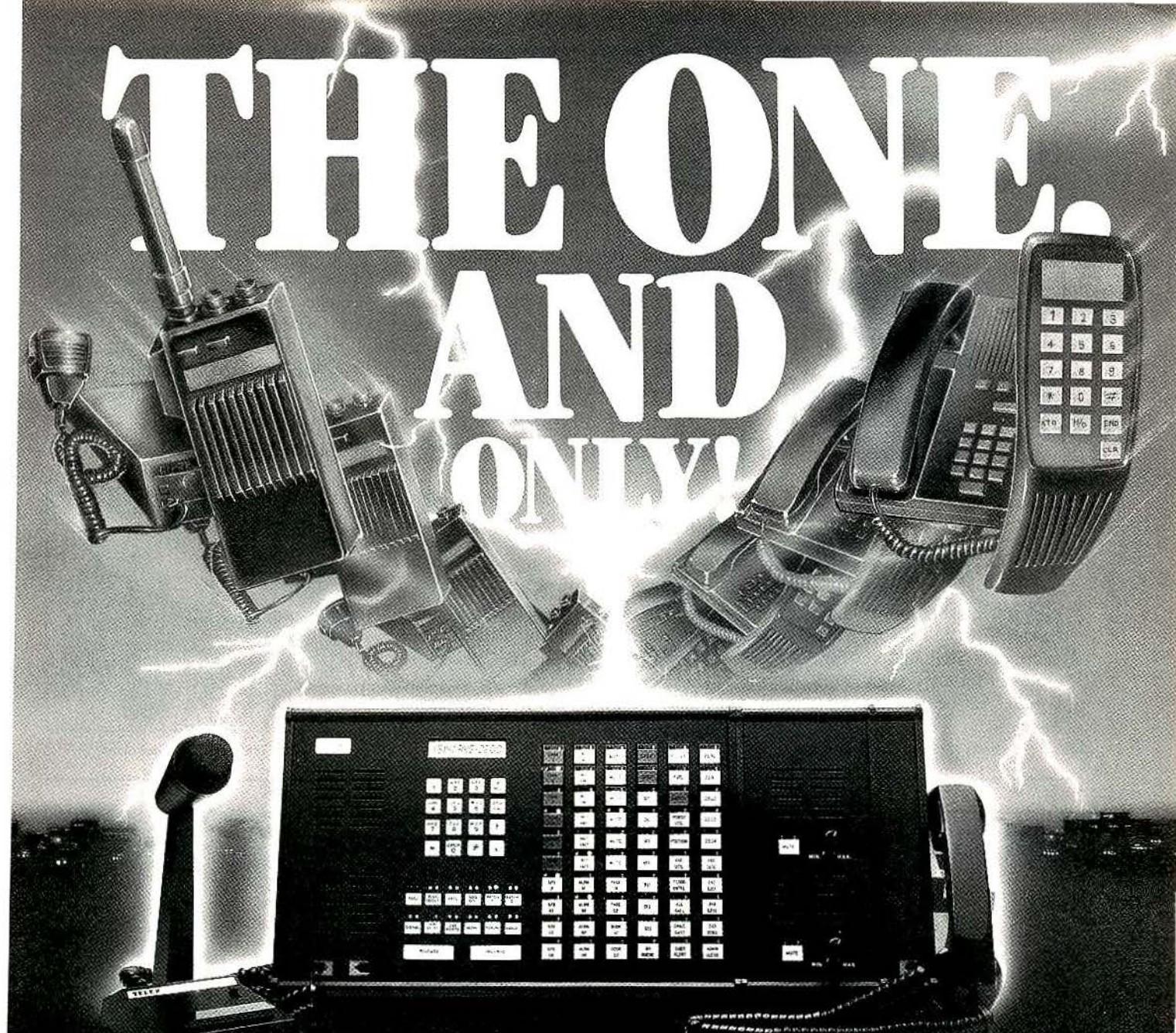
Tower services cover painting, maintenance

Tower services from **Trico Tower Service** incorporate tower painting, maintenance, inspection and consulting. The company handles towers used for paging, two-way, microwave, AM, FM and TV applications.

Circle (439) on Fast Fact Card



THE ONE, AND ONLY!



THE SYSTEM THAT FULLY INTEGRATES TELEPHONE AND RADIO IN ONE COMPACT CONSOLE!

POSITRON has the system that combines radio and telephone into one compact and versatile unit! It also integrates paging and call identification like no other system does!

Quicker, easier to use!

POSITRON re-defines "user friendly"! You enjoy faster access to features, because everything's at your fingertips, in one easy-to-operate unit!

More compact!

You get big-league performance with a small foot-print... everything you need, yet it takes up so little space.

Highly versatile!

Completely software programmable, POSITRON lets you easily configure your system to your particular requirements such as: • Queue 1 to 4 • Instant transmit • Speed dial • Take over dispatcher • Ring select. It is compatible with your current equipment and easily expandable to meet all your needs.

Highly reliable!

This POSITRON system was developed together with emergency services systems users thus ensuring the highest possible level of reliability.

E 9-1-1

Suppliers of E 9-1-1 Emergency systems and products.

For further information, write or call:



POSITRON

Where Communication Technologies Meet

Positron Industries Inc.

5101 Buchan Street
Montreal, Quebec, Canada H4P 2R9

(514) 345-2200

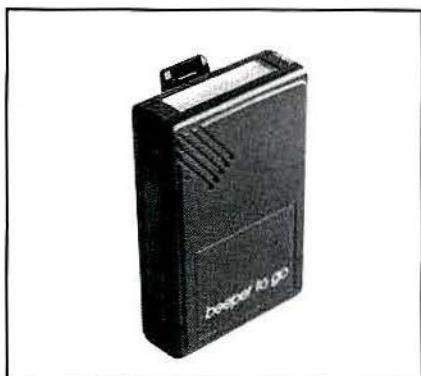
Head Office: Montreal Offices: New York, Chicago, Los Angeles, Toronto

Circle (89) on Fast Fact Card

CALL (800) 361-9698

New products

Display pager offers 10-message memory



The Samsung numeric display pager from **Beepers To Go** features a vibrator, 10-message memory, 12-digit display and light sensor for night viewing. Model SRP 5000N suits 900MHz use, and model SRP 3100N is for VHF operation. Service repair work for the pagers is performed by **Minilec Services**.

Circle (515) on Fast Fact Card

Network billing package eases SMR invoice ability

The Network Billing Package from **AmeriCom** in conjunction with **International Telecommunications Data Systems** allows SMR operators to quickly and effectively bill customers on invoices. The package enables more than 48 ways to charge for services and is fully automated.

Circle (497) on Fast Fact Card

Universal counter spans 5Hz to 175MHz bandwidth

Model 1823 universal counter covers 5Hz to 175MHz and features dual inputs. The **B&K Precision** counter includes frequency, period, period average, ratio and time interval functions. The unit comes with a detachable power cord, schematic and parts list, spare fuses and instruction manual.

Circle (440) on Fast Fact Card

FM portables achieve intrinsically safe rating

FM portable radios from **Midland LMR** are designed intrinsically safe under the ANSI and UL 913-1988 standard for use in Class I, Division I, Groups C and D hazardous locations when they are used with the appropriate batteries and accessories. Intrinsically safe models include 70-132/232IS, 70-135/235IS, 70-145/245IS, 70-165/265IS and 70-195/295IS. Models 70-195/295IS meet requirements for Groups A and B, as well.



Circle (382) on Fast Fact Card

"DRESS FOR SUCCESS"



UP GRADE YOUR CUSTOMERS TO THE SMC PREMIUM INSTALLATION KIT.

THIS DELUXE PACKAGE IS EASY TO INSTALL, GENERATES GREAT REFERRALS AND MOST IMPORTANTLY CREATES HIGHER PROFIT \$\$\$.

FOR COMPLETE INFORMATION CALL OR WRITE.

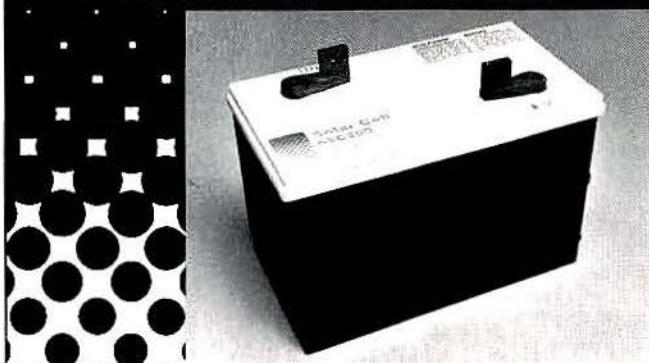
SMC

ELECTRO MOUNT

P.O. Box 1607, TOMBALL, TEXAS, 77377-1607
12519 WANDA LANE, MAGNOLIA, TEXAS, 77355
713-356-2584, 800-527-1079

Circle (90) on Fast Fact Card

Solar/Cell Batteries



Introducing the SC series of lead acid deep cycle batteries designed for extreme cyclic charging and discharging applications.

- Deep Cycle Dependability
 - Sealed/ Maintenance Free
 - Advanced Gelled Electrolyte
 - In Stock / Immediate Delivery
- For all your remote power needs:



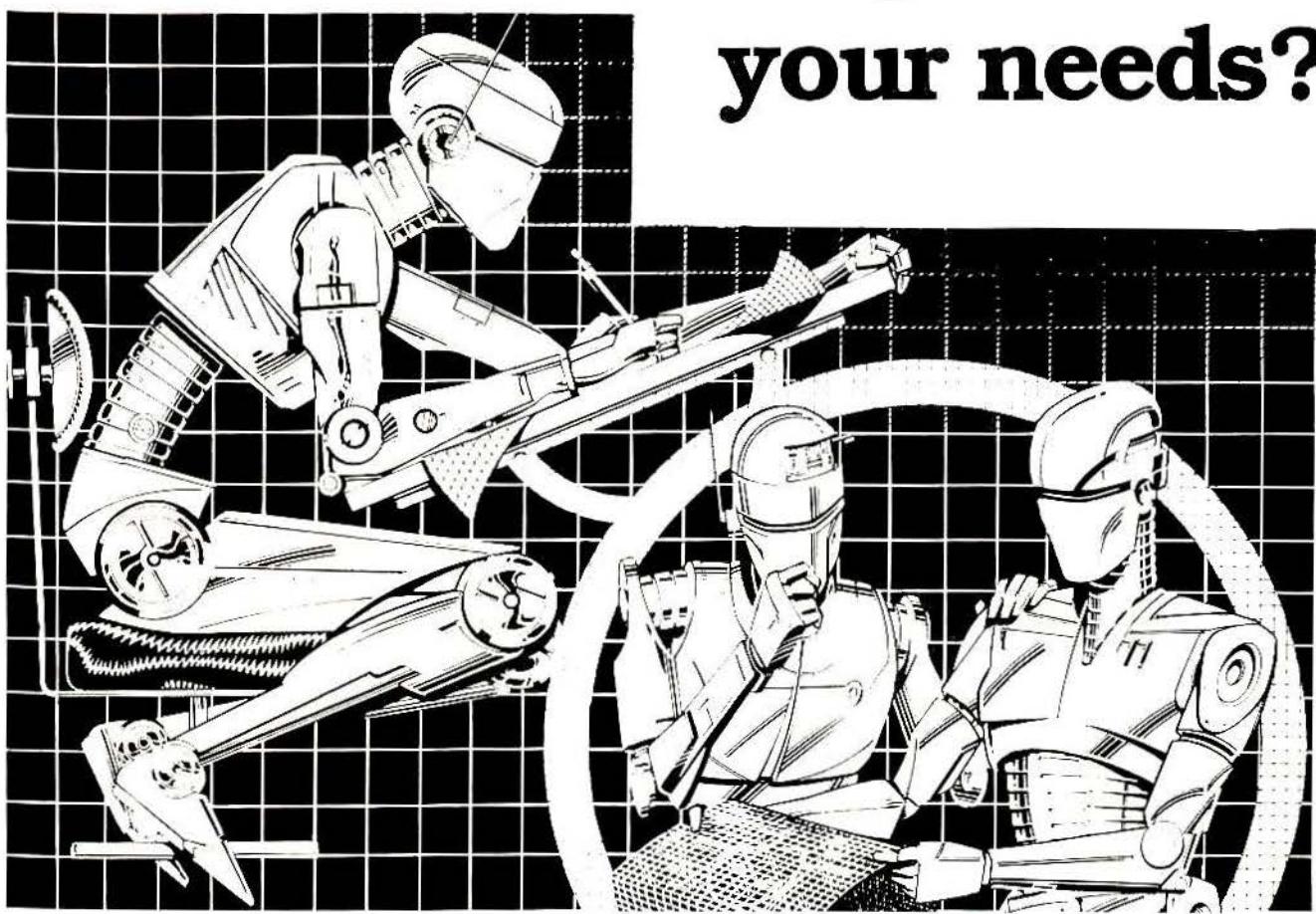
SOLAR ELECTRIC SPECIALTIES CO.

800-344-2003

P.O. Box 537, Willits, CA 95490

Circle (91) on Fast Fact Card

Tired of "Star Wars" LTR® networking solutions that are more complex than your needs?



You can have an LTR[®] dispatch networked system TODAY, without the huge investment or the mind-boggling complexity demanded by the expensive so called big-network approaches. RoamNET™ allows customers to roam to other systems and still be able to be reached by the base or other mobiles. The only requirement needed to allow RoamNET™ to operate, is an R5551 and a dial-up phone line/microwave/radio link installed on at least one channel on each system where networking is desired. You don't have to modify, or add different proms to the mobiles. With our built-in CTCSS capability, you can now network UHF/VHF systems and network between trunked and conventional channels in any frequency band! Intercompany/mutual aid networks can be easily and economically implemented to allow dispatch networking on each system. Best of all it's available TODAY!

**Price, Performance, Simplicity, make Sigtone's R5551
the ideal SMR dispatch networking solution.**



Sigtone Inc.
225 So. Swoope Ave Suite 105
Maitland, FL 32751-5786
Phone: 407-628-4828 FAX: 407-628-5820

SIGTONE™

Tired of paying for long distance calls for product support
or equipment purchases? Call SIGTONE toll free!

1-800-525-8663

LTR[®] is a registered trademark of the EF Johnson Company

MARK THIS PAGE...

If Your
Communication
system requires:

- Wide bandwidth in one radio
- Up to 99 channels available
- MIL SPEC 810 CD approved
- CTCSS tones
- Dealer Programmable radio
- Technical Support
- Clonable
- Custom Software available
- DTMF w/ANI mic
- Trunk mount

Then Contact:

**TAD
RADIO**

(509)326-1511

FAX (509)326-1430

for further information



Models Available:

M8-VHF MD150-VHF
M8-UHF MD450-UHF

In Canada PH(604)545-1150

Circle (93) on Fast Fact Card

New products

Rubber duck antennas
have BNC connector



A line of rubber duck antennas is available in 140MHz, 220MHz and 440MHz frequencies. The Valor Enterprises antennas have a BNC connector and vinyl-dip coating.

Circle (359) on Fast Fact Card

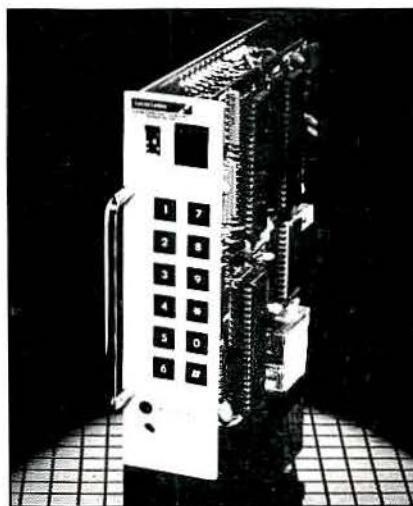
Phone mount covers
conceal wiring

Decor covers for Scientific Dimensions cellular phone mounts hide wiring. The covers are made of abrasion-resistant fabric and remove easily for adjustments to the communications equipment.



Circle (344) on Fast Fact Card

Tone converter card
answers PSTN calls

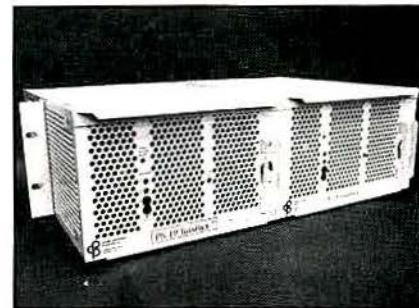


Model 2491 tone converter card converts DTMF codes to subaudible CTCSS, two-tone sequential paging and other four-tone selective call formats. The Lucas Ledex unit is capable of answering PSTN calls and switch audio or communications channels. It monitors a contact closure and sends a programmed paging or selective call code.

Circle (350) on Fast Fact Card

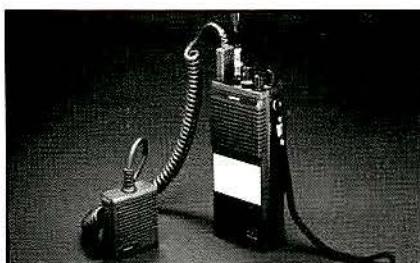
Power supply includes
various configurations

The PS-19 TwinPack power system from Power Conversion Products has a maximum weight of 25 pounds and can be configured with two rectifiers, with a rectifier and a ringing generator or with two ringing generators. Rectifiers are available for 24V and 18A output or 48V and 10A output. The ringing generators accept 24V or 48V with an output of 200 millamps, 100V at 20Hz. Features include front-access and plug-in power modules; convection cooling; no fuses required; separate alarm terminal block for remote alarms; and high output dc voltage shutdown with auto restart.



Circle (354) on Fast Fact Card

VHF, UHF hand-holds support 8 channels



The SynTronix VHF and UHF portable radios feature 5W and eight channels. The **Advanced Videotech** radios include diode matrix frequency control and surface-mount components. The radios come with a rubber duck antenna, wall charger, rechargeable battery, wrist strap, protective case and belt clip.

Circle (418) on Fast Fact Card

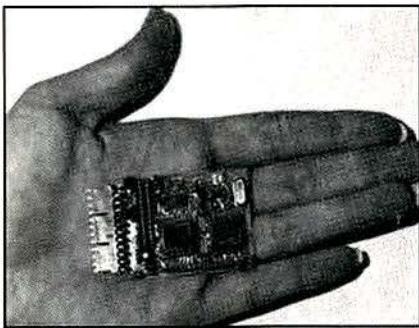
Hutton has
what it takes!

When You
Need It Now!

Encoder-decoder features programmable functions

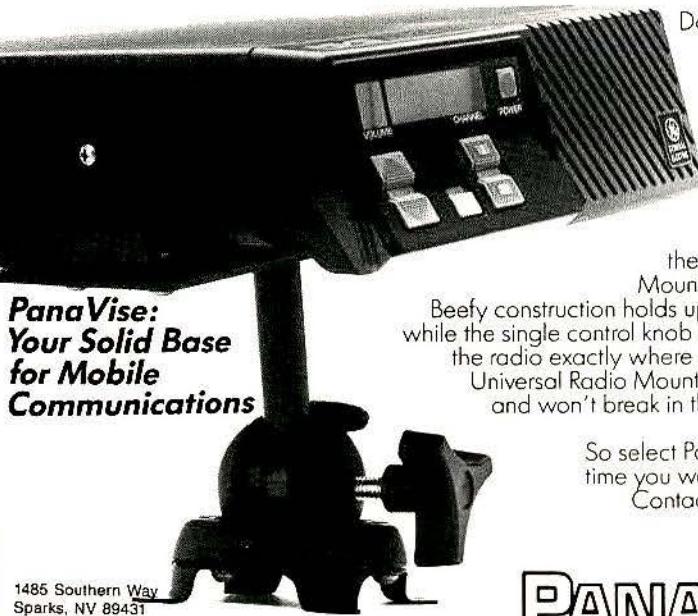
Model 3027 micro encoder-decoder weighs 0.5 ounces and boasts various programmable functions. Decoder functions include address coding of one to nine digits; group call and all call; 10dB SINAD; and adjustable timed output. Encoder functions include 10 pps signaling speed; transmit PTT; and initial delay. The **Bramco** encoder-decoder has 6Vdc to 15Vdc power.

Circle (476) on Fast Fact Card



WHEN YOU WANT IT DONE RIGHT!

Use the new PanaVise Universal Radio Mount



PanaVise:
Your Solid Base
for Mobile
Communications

1485 Southern Way
Sparks, NV 89431
Tel: (702) 353-2900
Fax: (702) 353-2929

Circle (74) on Fast Fact Card

Don't fool around with wimpy or light-duty cellular phone mounts when installing heavier, more expensive radios—use the Universal Radio Mount from PanaVise.

Beefy construction holds up to ten pounds, while the single control knob lets you position the radio exactly where you want it. The Universal Radio Mount is strong, stable and won't break in the field! Full one year warranty.

So select PanaVise the next time you want it done right! Contact your PanaVise representative.

PANAVISE®

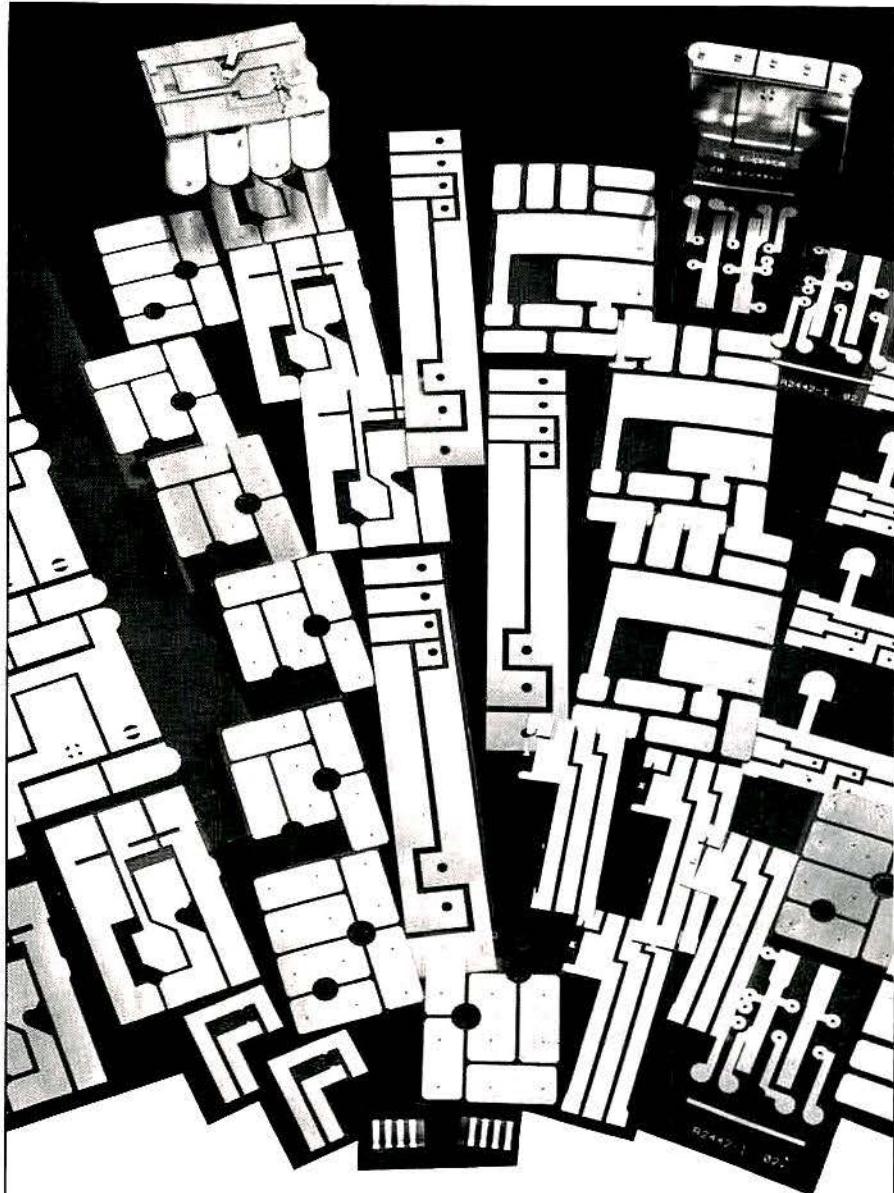
Andrew Corp./The Antenna Co. / Antenna Specialists API/Astron/B&K Precision Bandit / Beckman / Bird Bobier/Celwave/Centurion Communications Specialists / CPI Communications Cushcraft/Decibel Products Gamber-Johnson / Helper Instruments / Heliotrope General / Hustler / IFR/Jabro Johnson Controls / Kenwood / Maxrad / Motorola Radius Telemetry / Multiplier Optoelectronics/Ora Cellular Technology / PACE Paladin / Power Sonic RF Ind. / Ritron / ROHN Sat-Pak / SDI Selectone / Shure Bros. / SMC Electromount / SCI Siemens Solar Industries Sonnenschein / Speco / SSC Standard Communications TPL Corporation

CALL
1-800-442-3811

Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

HUTTON

Circle (95) on Fast Fact Card



ALEXANDER BATTERIES ANNOUNCES FLEX CIRCUITRY

Alexander now incorporates flexible circuit boards (patent-pending) in a wide line of replacement batteries.

Alexander flexboards reduce the number of internal connections and components to improve reliability and safety through uniform production.

Circuits are permanently bonded to a flexible plastic backing allowing consistent, compact and intricate designs. Slippage and shorting are eliminated.

Remain at the forefront of battery sales. Call your local authorized Alexander Batteries representative today.



Alexander Batteries

Call for a free brochure on Alexander Flex Circuitry

800-388-8314

Circle (96) on Fast Fact Card

New products

Recharging systems use solar electric technology

Battery recharging systems that rely on solar electric technology are available from Power-Pak. The Solarex recharging systems include high reliability; portability; and low maintenance.

Circle (424) on Fast Fact Card

Mobile, cellular fax link operates with tone decoding

The FaxLink Plus interface connects to Group III fax machines with two-way, trunked, microwave, cellular and satellite radios. The Link Systems interface provides tone decoding for the detection of voice and fax transmissions to switch to the proper receive mode. The unit comes with a selectable fully automatic answering function.

Circle (409) on Fast Fact Card

Equipment labels include bar coding, custom design

Malapex



PENNSEL™
POWER PAGE

Color, custom design, bar coding, serialization and other types of pager and equipment labels are available from Anchor Graphics. Clients can ship material (such as plastic, metal or wood) on which a label is to be printed to the company for processing. Labels can be ordered to match equipment colors, as well as labels can be made to match the thickness in a recessed area reserved for a label. Computer-printed labels for field service use are available.

Circle (435) on Fast Fact Card

800MHz 2.5W output portable meets military specs



Model 70-9301 800MHz portable includes a programmable repeater talk-around capability, top-mounted switch and user-selectable operation. RF output on the Midland LMR hand-held is 2.5W, and the unit meets military standard 810C and D. The radio works on Midland CMS trunked systems, conventional 800MHz channels or both. Functions include automatic fleet or subfleet channel access, private portable-to-base calls and multi-area and roaming operation.

Circle (380) on Fast Fact Card

Air conditioners meet shelter performance demands

The Marvair ComPac I and ComPac II air conditioners suit the conditions of communications and electronic equipment shelters. Available from Crispaire, the units features low and moderate temperature starting and operation; built-in reliability; rugged construction;

construction; and quick installation. In addition to these features, the ComPac II includes a factory-installed economizer that prolongs equipment life by using outside air when acceptable to cool the shelter.

Circle (486) on Fast Fact Card

"RADIOPASS" RADIO PERSON DOWN ALARM



THIS UNIQUE SAFETY TECHNOLOGY OFFERS SUPERIOR PROTECTION FOR USERS WORKING ALONE IN POTENTIALLY HAZARDOUS SITUATIONS.

- USE FOR NORMAL TWO WAY RADIO VOICE COMMUNICATION AND AUTOMATICALLY MONITOR USER SAFE STATUS
- LACK OF MOTION FOR PREDETERMINED PERIOD TRIGGERS USER WARNING, THEN FULL ALARM AT NO RESPONSE TO WARNING
- RADIO ALARM CONFIGURED FOR SHARED CHANNEL APPLICATIONS
- HIGH OUTPUT AUDIO ALARM (+95dBA) AIDS IN FAST LOCATING OF VICTIM

USER AND DEALER ENQUIRIES WELCOME

RADIO SYSTEMS, INC.

"Modern Concepts in Communications"

3400 Southwest 26th Terrace,
Ft. Lauderdale, Florida, USA 33312
TEL: (305) 587-9135
FAX: (305) 587-6738



Circle (97) on Fast Fact Card

Hutton has
what it takes!

HELIAX®

Hutton Communications is your direct connection to ANDREW Corp. HELIAX® in large quantity or small. From our new larger than ever cable facility, Hutton can supply all of your HELIAX®, Superflexible, or Radiax® order with your choice of connectors installed and guaranteed. PLUS we have hoisting grips, hangers and grounding kits IN Stock. Call Hutton today at 1-800-442-3811.

Main Feeders

1/2" Heliax®

7/8" Heliax®

1-1/4" Heliax®

1-5/8" Heliax®

We Make Jumpers!

1/4" Superflexible Jumpers

1/2" Superflexible Jumpers

Heliax® Accessories

Hoisting Grips

Tower Hangers

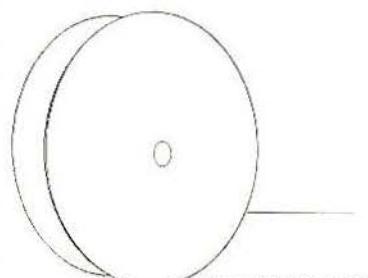
Standoff Kits

Grounding Kits

Connectors

Now we're rollin'

HELIAX®



Reels or Boxed

Heliax® is a trademark of the ANDREW Corporation.

Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811



Circle (98) on Fast Fact Card

Solving Communications Problems



Telex offers unique solutions to some vexing communications problems. How do you maintain two-way contact when your hands are busy working? Or, how to communicate clearly in a high noise vehicle? And, how to sustain safe communications from the surface with workers underground?

Ear-Mike®, an ear-worn transducer, lets users communicate by two-way radio while the hands are virtually free to do other work. Suitable for police work, security, DEA or SWAT teams, firefighters and rescue or EMS personnel. Works equally well under breathing apparatus or protective suits.

Communications Headset of rugged reliability for two-way radios or vehicle intercoms. Extensive model selection from lightweight units to under helmet configurations, with high noise attenuation (NRR -24 dB).

MAGNACOM™ emergency vehicle intercom with modular, weatherproof headset stations for external installations. Used on fire engines, EMS or rescue vehicles, customs and law enforcement power boats, utility trucks, airport de-icing crews or heavy construction equipment.

MagnaRope™ intercom for operation in tunnels, shafts, sewers, tanks, or mines. Consists of Ear-Mikes and load-bearing kermantle rescue rope with imbedded communications lines. Optional junction boxes accommodate multiple users.

For ready-made solutions to communications problems, please write LMR Dept., Telex Communications, Inc., 9600 Aldrich Ave. So., Minneapolis, Minnesota 55420, or phone 612-887-5596, during business hours, Central time.

© 1991 Telex Communications, Inc.

TELEX

Circle (99) on Fast Fact Card

New products

Automatic tuning combiner features modular design

The digital combiner autotuning system from Allgon works with coaxial, waveguide or dielectric combiners. The system automatically tunes cavities to the desired transmitting frequencies. It includes a modular design to accommodate a variety of racks and frames.

Circle (407) on Fast Fact Card

Lithium batteries sport high energy density

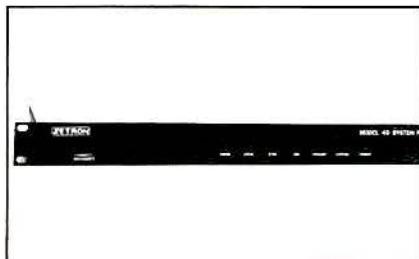


High energy density 3.6V lithium batteries are available in 1/2AA, AA, C and D. The Tadiran line features hermetically sealed batteries for a prolonged shelf life.

Circle (357) on Fast Fact Card

Telephone interconnect suits multiple-user systems

Model 40 system patch telephone interconnect works with Zetron's model 38 repeater panel and model 39 premium repeater panel. Model 40 suits multiple-user radio systems and includes

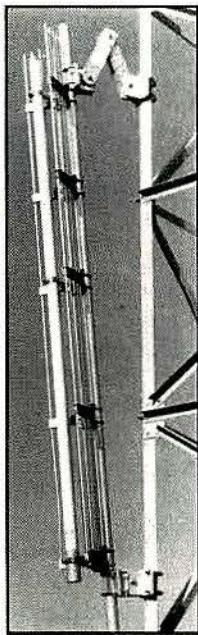


one end-to-end telephone input and one local telephone input. The interconnect works with simplex and half-duplex radio systems and recognizes 99 different users.

Circle (345) on Fast Fact Card

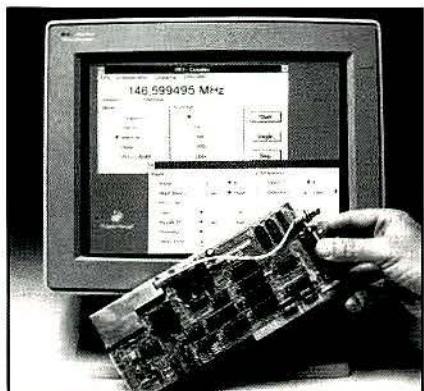
Mounting clamps adjust antenna beamtilt angle

Two mounting clamps are available from **Antenna Specialists** for precise mechanical adjustment of directional base station antenna beamtilt angle. The clamps permit maximum signal to be directed downward for null-fill or for eliminating adjacent site interference. Model ASP-988 adjusts from -3° to -15° of beamtilt in 1° increments. Model ASP-989 adjusts from 0° to -10° in half-degree increments.



Circle (443) on Fast Fact Card

Frequency counter covers 10Hz to 2,400MHz



Model PC-10 universal frequency counter-timer spans 10Hz to 2,400MHz and features self-calibration from any frequency. The **Optoelectronics** counter-timer is a 9-inch drop-in card for personal and laptop computers and uses Windows 3.0 as a control panel and display window. The unit features 10mV sensitivity and a 10MHz TCXO. The unit drops into an 8088 or higher based IBM-compatible PC with Windows 3.0.

Circle (412) on Fast Fact Card

Cellular phone houses alphanumeric pager

The PagerPhone pocket-size cellular telephone contains a built-in alphanumeric pager. Made by **Universal Cellular**, the product stores 40 80-character messages and records the time and date of receipt. The pager can be used to "screen" incoming calls.

Circle (488) on Fast Fact Card

Pre-engineered buildings incorporate custom specs

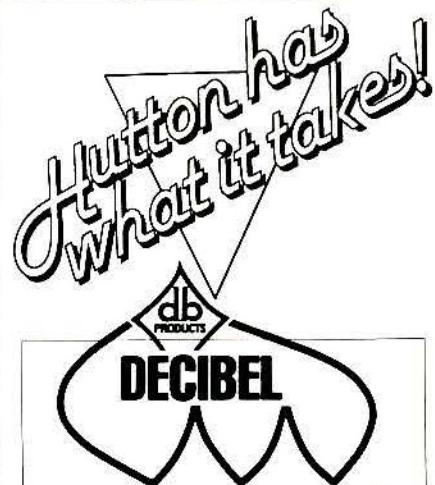
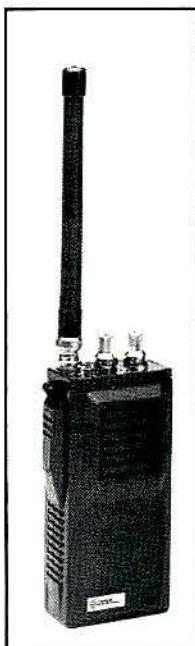
Pre-engineered buildings that meet communications specific requirement are offered by **Haddcomm**. The structures are constructed with the aid of computer-controlled machinery. The controlled environment equipment enclosures are made at the company's facility and shipped to the site. Company engineers oversee the building installation on the site. Standard pre-engineered shelters are available in addition to custom designs.

Circle (452) on Fast Fact Card

VHF transceiver has two channels, 2W output

The Minicom VHF transceiver features 2W output and two channels. The **Fanon Courier** handheld is available in three frequencies in the business band: 151.625MHz, 154.570MHz and 154.600MHz. The portable comes with one set of installed crystals, a rechargeable nickel-cadmium battery pack, ac battery charger, flexible antenna with BNC connector and an FCC license application. The radio has a channel selector switch, a high-low power switch, volume control, external antenna and a remote speaker/mic.

Circle (423) on Fast Fact Card



DB812F Omni DSD™ 12 dBd 806-960 MHz Base Antenna

With its 3-inch Horizon Blue™ fiberglass radome, Decibel's Dual Skirt Dipole™ antenna resists winds to 150 mph, with one-half inch of icing.

Specifications

Range: 806-960 MHz
Bandwidth: up to 110 MHz
Gain: 12 dBd
Downtilt: 1.5° built in
VSWR: 1.5 to 1 or better
Power: 500 watts max.
Impedance: 50 ohms
Length: 206" or 200"
Flange: Fixed

Other features include dipole collinear arrays, a 28-inch aluminum alloy extension pipe for mounting, a grounding brass tube from top to bottom for lightning protection, and drain plugs for moisture evacuation.

All radiators, feed and matching system components are made of copper or brass, which reduces intermodulation when several transmitters are combined on the same antenna.

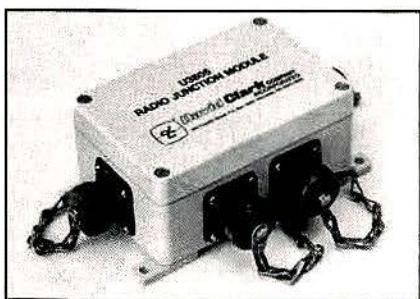


Hutton Communications
4112 Billy Mitchell Drive
Dallas, TX 75244-2315
214-239-0580
FAX 239-5264
800-442-3811

Circle (100) on Fast Fact Card

New products

Module simplifies installation of radio interfaces



Model U3805 junction module for use in the series 3800 communications system from **David Clark** accepts inputs from four radio interface modules and provides a single connection to a two-way radio. The module reduces the need for extensive cable, making installation simple. The product is weather-resistant and fits in a small space.

Circle (464) on Fast Fact Card

FSK modem features selectable baud rate

Plantronics model 1280A frequency shift key (FSK) modem from **Frederick Electronics** features remote control and status report; selectable baud rate to 600 for HF radio and 1,200 baud for wireline applications; and non-volatile memory. Operating parameters can be entered from the front-panel keypad. The unit incorporates data carrier detect.

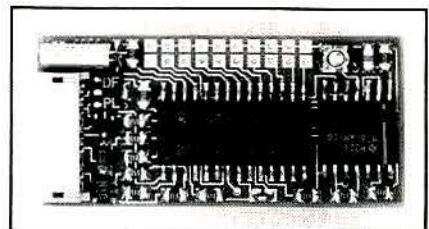
Circle (437) on Fast Fact Card

Satellite services tap SCADA, position tracking

Satellite communications services available from **Comsat Mobile Communications** include vehicle and vessel tracking and dispatching operations; supervisory control and data acquisition (SCADA); communications for remote business operation; and D-GPS (differential global positioning service). The services use Inmarsat-A and Inmarsat-C.

Circle (490) on Fast Fact Card

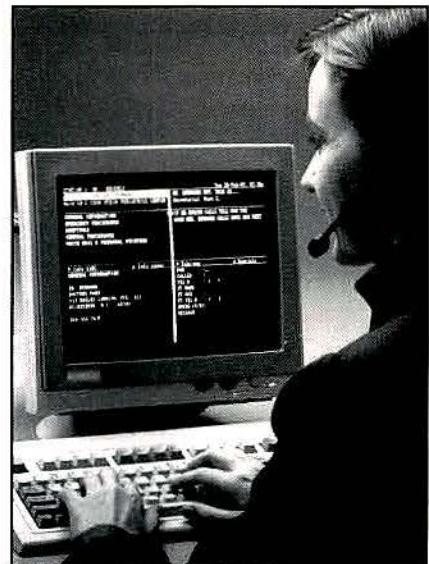
Encoder-decoder boasts microminiature size



The TS-64 microminiature encoder-decoder for FM transceivers allows programming of CTCSS tones between 33.0Hz and 254.1Hz using six PCB jumpers. The **Communications Specialists** board measures 0.78" x 1.70" x 0.25" and features time-out timer; receiver high-pass filter; and busy-channel lockout.

Circle (514) on Fast Fact Card

Alphanumeric system supports 1 to 7 stations



NUMERIC

uniden

- VHF, UHF, 900 MHZ
- POCSAG signalling format
- Holds up to 16 messages
- 128 Character memory
- Selective message delete
- Uses one "AA" alkaline battery

VCP

INTERNATIONAL, INC. DALLAS, TEXAS

COMMUNICATIONS DIVISION

P.O. Box 550999 Dallas, TX 75355-0999 Wats 800-527-9366 FAX # (214) 278-5981

Circle (101) on Fast Fact Card

NUMERIC

Panasonic

- Synthesized (Programmable/Reprogrammable)
 - VHF (980 frequencies)
 - UHF (400 frequencies)
 - 900mhz
- POCSAG Signaling Format
- Up to 8 Address Capability
- Vibrator Standard

VCP

INTERNATIONAL, INC. DALLAS, TEXAS

COMMUNICATIONS DIVISION

P.O. Box 550999 Dallas, TX 75355-0999 Toll-Free 1-800-527-9366 FAX (214) 278-5981

Circle (102) on Fast Fact Card

The PC-MX alphanumeric dispatch system uses voice mail transcription to streamline the dispatch process. Made by **Amtelco**, the text messaging and voice mail system can be configured for one to seven dispatch stations. The system includes preprogrammed dialing to send messages to alphanumeric pagers at the touch of a key. Messages can be dispatched to voice mail, pagers, remote printers, facsimile machines and personal computers.

Circle (339) on Fast Fact Card

Product certification includes listing, labeling

Product certification services for the land mobile marketplace are available from **United States Testing Company—California Division**. The testing program includes listing and labeling, and the testing generally takes less than two months. The program includes electrical, engineering and intrinsic safety testing.

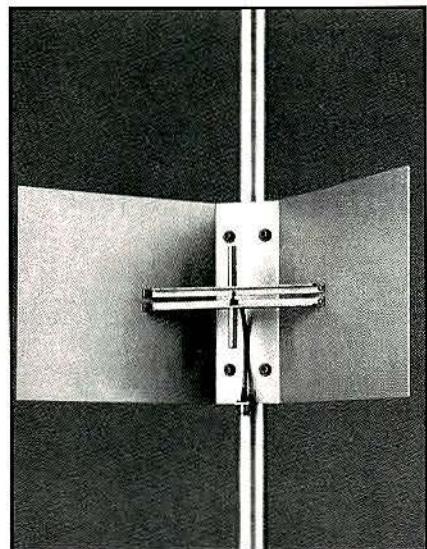
Circle (479) on Fast Fact Card

Tower services comprise analysis, maintenance

Tower services available from **American Tower Services** include sales, erection, foundations, maintenance, inspections, structural analysis, site leveling, soil analysis, path flashing, microwave dish installation, portable buildings and waveguide installation. The services cover rough terrain and heavy-duty jobs, as well as other needs.

Circle (480) on Fast Fact Card

Corner reflector antenna delivers 10.8dB gain



The corner reflector antenna from **Mobile Mark** features 10.8dB gain and good front-to-back ratio. The base station antenna comes assembled and has rugged construction. The antenna is available for the 800MHz-to-900MHz range and the 900MHz-to-1,000MHz range.

Circle (489) on Fast Fact Card

Security kit for portables carries whispers clearly



The SK-3 security kit for covert operation of a two-way portable provides clear transmission of whispered conversations. The **Dynatech Tactical Communications** set boasts overmolded strain reliefs at cable connection points for increased reliability. The kit can be used with the wireless earphone option.

Circle (400) on Fast Fact Card

99-channel mobile radio offers PC programmability



The Vertex 99-channel mobile features wideband frequency, computer-controlled operation, PC field programmability, user-programmable functions, programmable time-out timer, busy-channel lockout and built-in CTCSS. The **Yaesu** mobile also boasts permanent electronic serial number; eight-character alphanumeric LCD; preprogrammed priority, user and multiple group scan modes; built-in two-tone, five-tone, DCS, DTMF and ANI signaling; and programmable alarm settings.

Circle (481) on Fast Fact Card



NUMERIC GoldStar

VCP INTRODUCES THE GOLDSTAR PAGER

- Compact and Attractive Style
- POCSAG Signaling Format
- 12 Digit LCD Display
- 24 Digit Message Length
- Up to 15 Message Memory
- Reprogrammable Code Plug
- Lighted Display
- Area Indicator
- Vibrator Option

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION
P.O. Box 550999 Dallas, TX 75355-0999 Toll-Free 1-800-527-9366 FAX (214) 278-5981

Circle (103) on Fast Fact Card

TONE & VOICE

SHINWA

SMALL, POWERFUL AND RELIABLE

- Low band, VHF, UHF
- Two tone sequential
- Single "AA" battery
- Variable volume control
- Locking battery compartment
- Group call command
- Three year warranty

VCP INTERNATIONAL, INC. DALLAS, TEXAS
COMMUNICATIONS DIVISION
P.O. Box 550999 Dallas, TX 75355-0999 Wats 800-527-9366 FAX # (214) 278-5981

Circle (104) on Fast Fact Card

Catalogs offer antenna products

Antenex is offering two antenna catalogs. *Free Portable Antenna Catalog* combines and simplifies product selection and pricing for ordering. The sec-

ond catalog lists antenna products for mobile antennas, mounts and portable antennas.

Circle (428) on Fast Fact Card

Coaxial cable guide describes fire protection

Fire protection requirements for coaxial cable and elliptical waveguide are discussed in **Andrew's** guide. Definitions of building terms; code requirements; coaxial cable installation and application requirements; model building

code requirements; and the fire gas toxicity requirements of New York are included in "New Fire Protection Requirements for Indoor Installation of Coaxial Cable and Waveguide."

Circle (427) on Fast Fact Card

Brochure lists coaxial connectors

Coaxial connectors for two-way radio and cellular are described in **TCC Industries'** brochure. N series, mini-UHF series, BNC series, TNC series, UHF series and SMA series connectors are included.

Circle (468) on Fast Fact Card

Catalog lists antenna sites

Mountaintop, suburban and urban antenna sites are listed in **Sigma Telecommunications Properties** catalog. Coverage maps and FCC licensing information for its California, southern Nevada and southwest Arizona sites are included the 28-page publication.

Circle (462) on Fast Fact Card

Report examines voice processing systems

Sales of voice processing systems will surge throughout Europe, predicts a Frost & Sullivan report, *The European Market for Voice Processing Systems*. The market will leap from \$146 million in 1990 to \$780 million by 1994 with West Germany toppling the United Kingdom as the largest consumer.

Circle (478) on Fast Fact Card

Publication updates FCC licensing opportunities

Communications Licensing Update provides information on opportunities to file for and operate FCC licenses. The publication by **Waddill & Associates** covers licenses that will be available and when; license eligibility; how to apply for licenses; and how to get help when needed.

Circle (463) on Fast Fact Card

World's Smallest Multi-format ANI



ANI-UC

Size: 1.1" x .88" x .22"

Experience Midian's New Multi-format, Multi-feature ANI-UC with CTCSS encode

Includes the most popular ANI formats:

- | | | |
|--------|----------|----------|
| — DTMF | — ZVEI | — NATEL |
| — CCIR | — DZVEI | — EIA |
| — EEA | — DDZVEI | — MODAT® |

... Plus all formats and timings are totally field-programmable from 20 msec to 10 seconds per tone. Additional programmable features include Time Out Timer, Busy Channel Lockout, Front Porch Delay, leading and/or trailing ANI with emergency ANI and "man down" repeat delay timer. Includes CTCSS encoder with unique delayed CTCSS for inaudible ANI.

Midian Electronics, Inc.

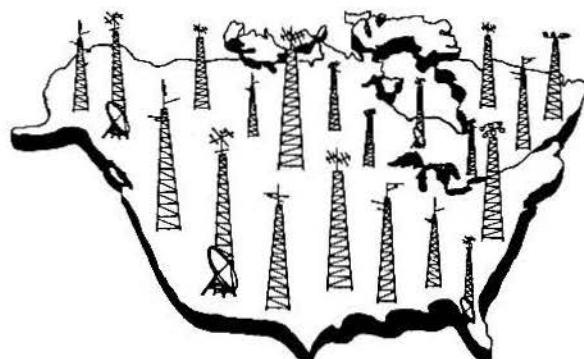
2302 E. 22nd St. Orders: 800-MIDIAN'S
Tucson, AZ Phone: 602-884-7981
85713 FAX: 602-884-0422



World Leader in Innovative Communications Technology

Circle (105) on Fast Fact Card

TITAN™ TOWERS are sprouting up all over North America



Available up to 96', TITAN self-support towers are now stronger, better, more versatile than ever.



TRYLON
MANUFACTURING CO. LTD.

P.O. BOX 186, 21 HOWARD AVE. ELMIRA, ONT. CANADA N3B 2Z6
TEL (519) 669-5421 FAX (519) 669-8912

Circle (106) on Fast Fact Card

Industry status nets 'average to good' rating

The state of the economy and a combination of the market demand and competition are contributing to the land mobile radio industry's current status, according to respondents to the January "What Do You Think?" questionnaire. The majority of the respondents peg the state of the industry as good to average. Statistics include:

STATE OF THE INDUSTRY	%
Excellent	10.2%
Good	42.9%
Average	20.4%
Fair	6.1%
Poor	4.1%
Needs improvement	14.3%
No response	2.0%

Respondents explain their assessment of the industry:

- "There is a confused state due to rapid growth and change. However, the industry is continuing to grow and mature."
- "Technology has brought many new markets. We have before us more opportunities than we ever have had with the coming of the 'wireless' society."
- "It is getting cut-throat with low-priced units and becoming harder to charge for service. It is cheaper to replace product than repair it."
- "There is a steady forward growth of equipment. There will be a need for replacement of present equipment and a need for purchase in the near future of updated equipment."
- "New technologies are emerging and being implemented at a good rate."
- "There is too much competition from mass merchandisers, and manufacturers no longer protect their dealers. It's a free-for-all, and being a full-service dealer means nothing."
- "There is a good product reliability and level of service. But frequency spectrum management and licensing needs improvement."
- "New technologies are emerging and weeding out obsolete ones. A new generation of technicians are coming on board, and growing pains will push industry standards up."

- "Cellular has hurt mobile phone business a lot."

In addition to the economy and market demand and competition, other factors contribute to the state of the industry. Multiple responses add up to more than 100% in these statistics:

FACTORS OF STATUS	%
Market demand/competition	49.0%
Economy	42.9%
Pricing	38.8%
Cost of doing business	26.5%
Other	16.3%
No response	10.2%

Now, a two-way line you can count on.

Count on Mobile Mark to come up with this new, economical two-way antenna: shown with a black-chrome base and a 1/4 wave whip. Available for 140-950 MHz.

It's just one dependable part of our new roof and body mount antenna line that includes UHF, VHF and Low band antennas.

All are engineered for outstanding performance, and backed by solid sales support and warranty.

Count on Mobile Mark for continuing service long after the sale, too. Our 43-year reputation for responsive service is unequalled in the mobile communications industry. Call today.



MOBILE MARK
COMMUNICATIONS ANTENNAS

3900-B River Road, Schiller Park, IL 60176 800-648-2800 or 708-671-6690

Circle (107) on Fast Fact Card

Feedback

Among the "other" factors affecting the industry's status that respondents wrote in are "The big three are falling flat on their faces"; "Direct battery sales"; Poor management"; "War in Iraq"; and "FCC 'non-regulation.'"

By far the leader in fastest-growing products, according to readers, is cellular equipment, followed by trunking products. Other leaders are reported in the statistics that follow. Multiple responses add up to more than 100%.

FASTEST-GROWING PRODUCTS	%
Cellular equipment	59.2%
Trunking products	38.8%
Computer products	30.6%
Mobile data terminals	30.6%
Portables	30.6%
Paging equipment	20.4%
Satellite equipment	20.4%
Mobiles	16.3%
Antennas	12.2%
AVL equipment	12.2%

Other ACSSB products	10.2%
	4.1%
Power supplies	4.1%
No response	4.1%
Ancillary equipment	2.0%
Test equipment	2.0%

Respondents cite reasons for the product categories that are growing rapidly.

- "Computer advances have begun to be felt in two-way. These advances should accelerate."
- "Manufacturers are reducing the number of mobile models and expanding portable capabilities through new technologies."
- "Trunking is only coming into its own and is now familiar to the user. Adequate products are now available from numerous sources."
- "90% to 95% of all new sales are cellular or trunking."
- "Mobile data will be the next high-growth market, especially when product becomes more affordable to fleets of 20 or fewer vehicles."

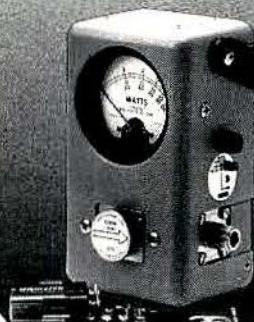
- "Cellular itself is still exploding. Mobile data applications via cellular will become more prevalent as digital standards and ISDN become a widespread reality."

Readers cite technological advancement that they believe will spark the industry to grow further. These include:

- "The development of PCN and the wireless office and business environment."
- "Complete transition to digital transmission systems."
- "Satellite paging and cellular systems."
- "Multiband radio equipment."
- "More surface-mount devices in radios."
- "The further miniaturization of equipment with greater flexibility and reliability."
- "Smaller integrated circuits, satellite paging and satellite cellular phones."
- "The re-allocation of under-used VHF TV and government frequencies."



MEASURE PEAK POWER OF SSB AND AM SIGNALS WITH THE MODEL 43P WATTMETER



Get all the measuring capability of our standard Model 43 Wattmeter, PLUS true peak power measurements of SSB, AM and limited pulse signals with the Bird Model 43P. The 43P measures peak power at $\pm 8\%$ full scale accuracy, without affecting CW operation or accuracy. And standard plug-in elements make it

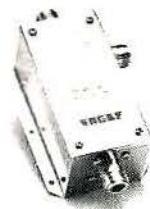
who else but
BIRD

simple to operate. Or add this capability to your standard Bird Model 43 Wattmeter with retrofit kit Model 4300-400. Simple, immediate installation — no soldering, no holes to drill or modifications to make. Contact your Bird distributor or the factory for details on the Model 43P Wattmeter or the retrofit kit.

30303 Aurora Rd., Cleveland, Ohio 44139 • (216) 248-1200 • TLX: 706898 Bird Elec UD
Western Sales Office: Ojai, CA (805) 646-7255

© Copyright 1990 Bird Electronic Corp.

Circle (108) on Fast Fact Card



Return Loss Bridges

The modern way to measure SWR. Bridges can be used with service monitors or spectrum analyzers for swept SWR measurements. EAGLE RLBs have these features:

- Frequencies: .04 MHz to 1.0 GHz
- RF reflected port
- High Power rating: Five watts
- Rugged construction
- High Directivity: up to 45 dB

Model RLB150N3A \$289.00
Model RLB150N3B \$329.00

FREE application note: "High Performance VSWR measurements", call and ask for it!

EAGLE
WICHITA

P.O Box 9446 (316) 942-5100
Wichita, KS 67277 Fax:(316)942-5190

Circle (109) on Fast Fact Card



Fath



Bailey



Grabe



Edhall

Appointments at Ericsson GE's Land Mobile Radio Business (LMRB), Lynchburg, VA:

Dr. George Fath advances from vice president of engineering to vice president and general manager of the worldwide LMRB division.

James W. Bailey advances from eastern regional sales manager to vice president and regional manager for the North American region.

Lennart G. Grabe moves up from executive vice president of Ericsson GE Mobile Communications Holding to vice president and regional manager for the LMRB division's Far East, Pacific and Latin American regions.

Jan Edhall advances from mobile telephone systems marketing director to vice president and regional manager for Europe and the Middle East.

Dennis C. Connors moves up from public service marketing manager to director of marketing and sales support.

Kevin Schlabach exits Bacon Audio/Telecom, Atlanta, as account executive to join Teletec, Raleigh, NC, as regional sales manager.

Roger Farmer leaves Bendix/King Mobile Communications, Lawrence, KS, as international sales manager to become director of sales for Kyodo West, Bridgeville, PA.

David J. McDowell leaves Cue Paging, Newport Beach, CA, as president to become vice president of cellular subscriber products for Hughes Network Systems, Washington, DC.

Wayne Morris exits Glenayre Electronics, Atlanta, as vice president of sales to become president of Enhanced Telecommunications, Norcross, GA.

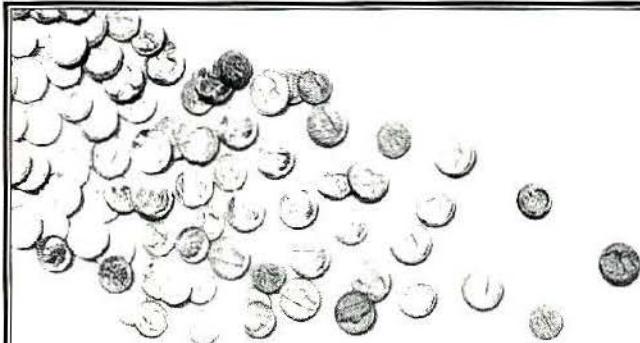
Frank Cannavo departs Texas Instruments, Control Products Division, as program and strategy manager to become field sales manager for Peerless Radio, Lynbrook, NY.

Appointments at SMC Electro-Mount, Tomball, TX:

Felix Venezuela advances from operations manager to managing director of SMC's international division.

Brett Hesser leaves Kimberly Clark, Houston, as sales manager to become national sales manager for SMC.

Steven Denoms exits Sherwin Williams, Cleveland, as director of research and development to join SMC as product development manager.



How To Turn Your Nickels And Dimes Into Dollars And Sense.



Good business sense says that if you look after the nickels and dimes the dollars will take care of themselves. Dollar for dollar, C\$ERVICE® is the most cost effective computerized service management system available.

C\$ERVICE® provides for invoicing, accounts receivable, inventory ordering and tracking, work tickets, technician productivity, maintenance contract profitability analysis and equipment service history. And C\$ERVICE® supports single or multiuser environments.

C\$ERVICE® is exceptionally easy to install and is backed by knowledgeable and friendly customer support.

For a brochure describing C\$ERVICE® in detail or for a free demo diskette call toll free:

C\$ERVICE®

800-542-9378

307-382-5663 • 307-382-7323 FAX

America West C&E, Inc.

311 Washburn Drive • Rock Springs, WY 82901

How many times have you been hit...



and
didn't know it?

LSC-10

LIGHTNING STRIKE COUNTER

Shunts tower, coax, pipe, etc. • Water tight-strike powered. • See if grounding/protection is making a difference! • Available for power/phone lines too.

KPolyPhaser
CORPORATION

2225 Park Place / P.O. Box 9000 / Minden, NV 89423-9000
(800) 325-7170 / (702) 782-2511 / FAX (702) 782-4476

Circle (111) on Fast Fact Card

RTX and DTMF Compatible

Wide Band UHF & VHF NEW



Introducing the Unibel 707 series. The Unibel model 707 is a fully integrated package that includes radio, telephone handset, and signalling for RTX as well as DTMF encode & decode. Plug in the cellular type backlit handset and simply program the frequencies, and protocols through the handset. The signalling is already factory incorporated into a MIL spec Midland radio. Now your customer can simply dial the number and press send. Sound familiar? Call us for more information.

unibel
(800) 663-8731

Unibel Developments Inc.
200-1960E Dayton St. Kelowna, BC V1Y 7W6
Phone (604) 862-5200 Fax (604) 862-4986

Circle (112) on Fast Fact Card

C alendar

August

5-10—National Professional Electronics Convention, Nugget Hotel, Sparks, NV. The International Society of Certified Electronics Technicians (ISCT) also will meet. Contact: NESDA/ISCT/NPEC, 817-921-9061.

12-15—Associated Public-Safety Communications Officers 57th National Conference, Tulsa, OK. Contact: 800-824-1850.

September

19-21—International Mobile Communications Expo/Fall, Orange County Convention Center/Civic Center, Orlando, FL. Contact: 303-220-0600.

21-25—International Association of Fire Chiefs Annual Meeting, Toronto. Contact: 202-833-3420.

25-28—Special Industrial Radio Service Association Annual Meeting, Hyatt Lake Tahoe, Incline, NV. Contact: Barbara J. Levermann, 703-528-5115.

October

5-10—International Association of Chiefs of Police Annual Meeting, Minneapolis. Contact: 703-243-6500.

21-24—Mobile Communications Marketplace, Anaheim Convention Center, Anaheim, CA. Contact: Telocator, 800-422-4862.

November

14-17—Communications Marketing Conference, Embassy Suites Hotel, Denver. Contact: Gene Johnson, Vega Signaling, 818-442-0782.

22—Radio Club of America Annual Meeting and Awards Banquet, New York Athletic Club, New York. Contact: 201-246-7271.

1992

February

7-13—Cellular Telecommunications Industry Association 1992 Winter Meeting and Exposition, New Orleans. Contact: 202-785-0081.

18-20—International Mobile Communications Expo/Spring, Las Vegas Convention Center, Las Vegas. Contact: 303-220-0600.

March

29-April 1—Energy Telecommunications and Electrical Association '92, Dallas Convention Center, Dallas. Contact: 214-235-0655.

May

13-15—Radiocomm Annual Convention, Montreal. Contact: Laura La Prairie, 416-483-5176.

June

23-25—Utilities Telecommunications Council 44th Annual Meeting, Hyatt Civic Plaza, Phoenix. Contact: Rita Clark, 301-621-7802.

August

9-13—Associated Public-Safety Communications Officers 58th National Conference, Washington State Convention Center, Seattle. Contact: 800-824-1850.

September

2-4—International Mobile Communications Expo/Fall, Georgia World Congress Center, Atlanta. Contact: 303-220-0600.

22-25—Mobile Communications Marketplace, Moscone Center, San Francisco. Contact: Telocator, 800-422-4862.

P

rofessional services

ERICSSON



13 years of
nationwide GE service

PROMPT REPAIR OF ALL
CONVENTIONAL GE MOBILE
RADIO PRODUCTS

1-800-637-6799

PH (916) 383-8224 **S** Technical Services Fax (916)
5310-D Power Inn Road, Sacramento, CA 95820



SI

Technical Services

383-8230

5310-D Power Inn Road, Sacramento, CA 95820

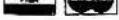
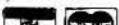
J. NED HINES
CONSULTING ENGINEER
Design, Fabrication, & Test of
Custom Prototype Antennas

22 KNOllWOOD ROAD
(201) 539-6976 MORRISTOWN, NJ 07960

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID

Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936



COMMUNICATIONS CONSULTING SERVICES



10 Woodbridge Center Drive **COMMUNICATIONS
CONSULTANTS, INC.**
Woodbridge, NJ 07095
(201) 636-6970
Toll-Free: (800) 247-4796 • FAX: (201) 636-7260
Offices in: Albany, NY; Alexandria, VA; Boston, MA; Detroit, MI;
Fort Lauderdale, FL; Honolulu, HI; Houston, TX; Phoenix, AZ;
Richmond, VA; San Diego, CA; London, England.

CAMBRIDGE ELECTRONICS TRAIN SYS.

Transit Communications Specialists

S.T. Lagana, President
Jamaica Plain, Mass. 02130 617-524-1555
Fax (617) 524-4544
Admin. Office (508) 685-0326
Fax (508) 688-6368

PORTA-TECH

1106 Laxton Road • Lynchburg, VA 24502



FACTORY TRAINED
TECHNICIANS
FOR QUALITY SERVICE

PORTABLE
TECHNICAL
SERVICE, INC.

GE Portable Radio Service Depot
Factory Approved Nationwide

- Current Product Lines
- Voice Guard Certified
- Public Service Trunking
- Surface Mount Technology

(804) 239-3049

THE PORTABLE DEPOT, Inc.

SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE

- FACTORY TRAINED TECHNICIANS •
- SURFACE MOUNT TECHNOLOGY •
- FACTORY APPROVED NATIONWIDE •
- PUBLIC SERVICE TRUNKING • VOICE GUARD CERTIFIED •
- Route 2, Box 338C • Lynchburg VA 24501
within 5 miles of the factory
804-237-3427



Telecommunication & Information Science Division

Public Safety, Transit, Government & Industry

CORPORATE OFFICE
MIRZA M. AHMAD 1401 McCormick Drive
Senior Engineer Landover, Maryland 20785

(301) 925-9400
(800) 288-1-SFA
Fax (301) 925-8612

LIGHTNING PREVENTION SYSTEMS



STATIC DISSIPATION AND
GROUNDING SYSTEMS
FOR COMMUNICATIONS TOWER SITES

2048 Cross Keys Road, Berlin, NJ 08009
FAX 609-767-7547 • (609) 767-7209
Don't Wait Until It's Too Late!

C

lassified

Advertising rates in Mobile Radio Technology's Classified Section are \$64.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Contact Carla Gaminu at (303) 762-1249 in Denver to place your classified ad, or send your classified advertising materials and order to **Mobile Radio Technology**, Advertising Department, P.O. Box 12901, Overland Park, KS 66212.

Tower space

SITE OF THE MONTH

40 13' 45"
75 05' 24"

Tinton Falls, NJ
560' AMSL

This outstanding transmitter site provides shoreline area coverage of the Garden State Pkwy., Rt. 195, 9, 18, 34, 35 and 36.

Call for FREE Site Listings

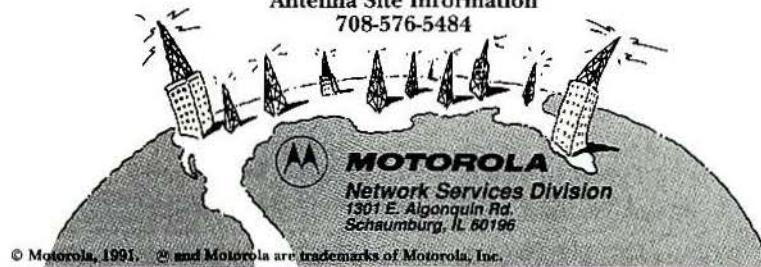
AAT Communications Corp.
1854 Hyland Blvd., S.I., NY 10305
Site Division (718) 979-6600

We've got you covered.

For superior antenna site coverage along with the Quality and Customer Service you expect from an industry leader - choose Motorola. Our nationwide network of antenna sites offers you space on thousands of premier antenna sites across the country. Contact Motorola Network Services Division today for your local and national site needs or to find out more about our site planning and management services.

**U.S. Network Services Division,
Antenna Site Information**

708-576-5484



Circle (120) on Fast Fact Card

Tower space

TOWER SPACE

Victorville at 4482 and Barstow, CA at 3325 feet.
MICROWAVE CIRCUITS BETWEEN SITES.

CALL NOW: (818) 308-0398
FAX: (818) 308-3909

SEATTLE AREA

Commercial power with generator backup.
Good security. Year around access.

GOLDSPAR COMMUNICATIONS
206-588-3459
Fax 206-581-2205

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi
ANTENNA SITES, INC.
602-451-7702

UNBELIEVABLE RADIO SPACE AVAILABLE!

You'd be crazy not to look at the only site in downtown Boston that CAN HEAR has NO INTERMOD and GUARANTEES IT IN YOUR LICENSE AGREEMENT. 1.3 miles away and at 723' its ONLY 53' shorter than the Prudential and has precabled telco & emergency power, air cond., 24 hr access, good lighting, fiber and more.

CALL NOW, YOU'LL BE IMPRESSED.

Lat 42° 21' 08" Long 71° 03' 25"

Skyline Antenna Management, Inc.
Call Peter Kovaleski, 203-684-4444

Circle (121) on Fast Fact Card

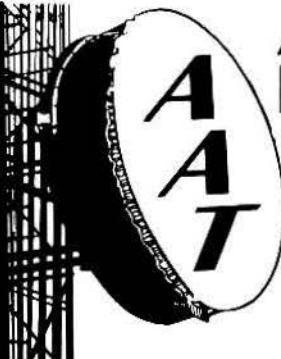
PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AML 2635' AAT, Overlooking Reno and Fallon and the I-80 corridor,

CALL NOW, **702-827-6060**
HIGH COUNTRY COMMUNICATIONS

TOWER SPACE SOUTHERN CALIFORNIA

35 sites ranging from Santa Barbara to Mexican Border. Stand-by power.
Ask for Jack Reichler
MERIDIAN COMMUNICATIONS
23501 Park Sorrento, #213A
Calabasas, CA 91302-1355
(818) 888-7000
Since 1956



ANTENNA SITES

N.Y., N.J., PA., CT., MD., Del., FL., MA.

Specializing in: acquisitions, management, selection, leasing, engineering, and installation. Concentrating in N.Y., N.J., PA., and CT.

Contact Site Division

TEL. (718) 979-6600 FAX (718) 351-7324



AAT COMMUNICATIONS CORPORATION

1854 HYLAN BOULEVARD, STATEN ISLAND, NY 10305

Circle (122) on Fast Fact Card

SPECTRUM
ENGINEERING COMPANY
11211 KATY FREEWAY, SUITE 390
HOUSTON, TEXAS 77079

**SITE MANAGEMENT,
ENGINEERING &
CONSTRUCTION**

*Proven reliability
& work record*

Most valuable sites in Houston, San Antonio, Laredo, Fort Worth, Corpus Christi, and Austin

Phone: (713) 984-8885
Fax: (713) 984-0066

NEED TENANTS??

Advertise your sites in the
NATIONAL COMMUNICATIONS SITE DIRECTORY

Dedicated to advertising antenna sites for lease

NEED SITES?

Then NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRAFAM, Dept. M, P.O. Box 6093
Freehold, NJ 07728 (908) 462-5964



TEL: (708) 823-7713

**CHICAGO TOWER
LEASING CORP**

COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA

P. O. Box 31160
CHICAGO, IL 60631

**TOWER SPACE
NEW ENGLAND AREA**

Foxboro, MA: Lat. 42-05-43, Lon. 71-13-52
AGL 465' AML 865'
Kingston, MA: Lat. 41-57-45, Lon. 71-43-01
AGL 468' AML 728'
Medford, MA: Lat. 42-25-51, Lon. 71-05-22
AGL 350' AML 538'
Johnston, RI: Lat. 41-48-12, Lon. 71-33-27
AGL 490' AML 990'
Hopkinton, RI: Lat. 41-29-41, Lon. 71-47-05
AGL 464' AML 849'
Farmington, NH: Lat. 43-21-16, Lon. 71-04-19
AGL 592' AML 1600'

SOUTH FLORIDA TALL TOWER

Miami, FL: Lat. 25-58-15, Lon. 80-12-32
AGL 1044' AML 1049'

Industrial Electric & Electronics, Inc.
100 Marion Drive
Kingston, MA 02364
CONTACT: DAVE FENTON
1-800-323-7212 Outside Mass.
1-800-696-9109 Mass. Only

Tower space

COMMUNICATIONS SITE SPECIALISTS.

Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing.

Prime Sites Available Now ... IN, MA, MD, MI, NC, OH, VA



FACILITIES MANAGEMENT, INC.

10 Woodbridge Center Drive, Woodbridge, NJ 07095
(908) 636-6970 • FAX: (908) 636-7260 • Toll-Free: (800) 247-4796

© 1991, RAM Facilities Management, Inc.

Computer software

RADIO SYSTEM DESIGN

Computer Software for PC's

- * Radio Coverage
- * Geographic Boundaries
- * Path Profiles
- * Digital Topography - 3" and 30"
- * Demographic Analysis
- * 3-D Displays
- * Full Range of Design Options

J M A - Applied Spectrum Research

2975 Valmont #100

Boulder, CO 80301 USA

(01) 303 444 4871

FAX: 303 444 4872

Computer software

Computer Resources, Inc.

The Service Management System is designed for management of a mobile communications company. The Service Management System provides the user with the ability to produce work orders and work order history, inventory control and purchasing, contract maintenance and costing, equipment maintenance and costing, technician productivity, recurring billing, SMR Billing, pager billing and inventory control. Along with Accounts Receivable, Accounts Payable, Payroll and General Ledger.

205/591-8810

Circle (123) on Fast Fact Card

DESENSE PLUS™

Perform Transmitter Noise/
Receiver Desensitization Analysis
In minutes rather than hours!

PC-based software automates looking up receiver desense and filter curves. Intelligent data entry algorithms check input for errors. Works with all Land Mobile radio bands, 25-1,000 MHz. Evaluates up to 200 frequency pairs per site.

\$295 With A No-Risk 30-Day Trial

For a detailed brochure, call 1-800-845-0408

Service Management Software

The COMPLETE LMR Shop tool kit - Announcing VERSION 2.0!

INVENTORY: Parts list building, serial # tracking, warranty database, FAST price checks, low and out reports, plus cross reference by DESCRIPTION.

REPAIR ORDERS: Track active repairs by Account #, or status. Builds shop history indexed by Account #, Model #, Serial #, or by Vehicle. Automatically subtracts parts from inventory and optionally prints tickets on YOUR forms!

REPORTS: Customer, Inventory, Invoicing, Frequency Rolodex, Shop Productivity and Service Contract Analysis.

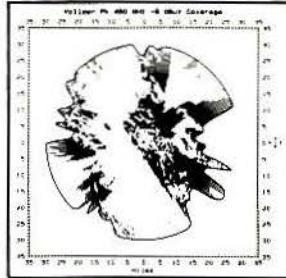
Completely menu driven with on-line "pop up" help. Runs on any IBM PC compatible with 512K + HD. Complete package - \$149. FREE demo and manual.

Pyramid Communications

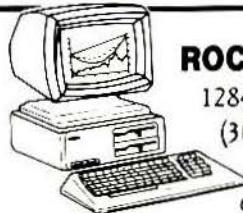
210 MAIN ST., SUITE 153, SEAL BEACH, CA 90740 (213) 430-5892

VHF/UHF LAND MOBILE RADIO Predicted Area Coverage Software

- FSPL, PEL, Okumura, Shadow Area Models
- Terrain Loss & Earth Curvature Computed
- Omni or Directional Antenna Patterns
- Plot up to 360 Radials & 3 Receive Levels
- HP-GL™ Plotter Support for Direct Map Overlays
- Interactive Spreadsheet Approach for Data Entry



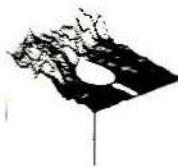
Complete Predicted Area Coverage Package \$695



ROCKY MOUNTAIN COMMUNICATIONS, INC.

12844 West Iliff Avenue ■ Lakewood, Colorado 80228
(303) 988-3395 Fax: (303) 969-9440

Computer Software for Communications Engineering Applications



SoftWright
12033 East Ohio Avenue
Aurora CO 80012 USA
(303) 329-6388
FAX (303) 329-0901

Terrain Analysis Package (TAP)™

PC-based software for RF studies

- Area field strength coverage maps.
- Shadow maps.
- Choice of propagation models.
- Point-to-point/microwave fade margin and reliability calculations.
- User-customized data base for buildings and vegetation.
- Digital elevation data on floppy disk or CD-ROM.
- Intermodulation product studies.

Free demo disk upon request.

Circle (124) on Fast Fact Card

Real World Propagation™ Studies

- On-Line Services
- FCC and FAA Data Files for PC
- 3 Second Terrain Data on CD-ROM

Richard L. & Richard P. Biby, Principals



**Communications
Data Services, Inc.**

6105-E Arlington Blvd. • Falls Church, VA 22044
(703) 534-0034 • Telefax (703) 534-7884

COMPUTERIZE your

• FCC LICENSING
with quickform 574 (\$495).

• PRICE QUOTES
with Minute Quotes. (\$495)
Includes Radius database
for Radius Dealers.

Both Packages Radius Co-opable.
Over 1,000 HAPPY CUSTOMERS

Slattery Software (619) 560-0644



Classified

Computer software

CEMS

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS

- MENU DRIVEN, COLOR CODED
- ON-SCREEN PATH DESIGN
- REFLECTED SIGNAL ANALYSIS
- ROUTE AND SYSTEM MAPS
- GRAPHIC MAP CROSSINGS
- GREAT CIRCLE CALCULATIONS
- PERFORMANCE PREDICTIONS: DIGITAL, ANALOG AND VIDEO
- GRAPHIC AND TABULAR INTERMOD PRESENTATION

SEND FOR DEMO DISK

Norton Engineering
10002 McDuff Court
Vienna, VA 2218-3156
(703) 938-5745
FAX (703) 938-9168

3 Second Terrain Data

CD ROM and Floppy

Circle (125) on Fast Fact Card

MICROWAVE ENGINEERING PROGRAMS

Computer Software for Microwave Engineering Applications

- Path Profiles - Real Time
- Path Analysis
- Quadmap Crossover Points with Quadmap Names
- 3 & 30 Second TOPO Data. HAAT Calculations

ROCKY MOUNTAIN COMMUNICATIONS, INC.
12844 West Iliif Avenue ■ Lakewood, Colorado 80228
(303) 988-3395 Fax: (303) 969-9440

TAME THE SNARLS

- Duplicate Capsodes
- Agonizing Over Pager Orders
- Poor Channel Throughput
- Co-Channel Pager Add-ons
- Indecipherable Log Books, Index Cards Etc.

CAPCODE MASTER VERSION 2
IBM-PC or Compatible, Multi-User Ready

Executive Business Systems (216) 398-7854

Circle (126) on Fast Fact Card

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo-Graph (Profiles)
- HAAT Calculations

NOW!
INTEGRATED SOFTWARE FOR TWO WAY RESELLERS

The TwoWay MANAGER

Performs 42 Sales, Accounting and Management functions

SIGMA-M C&E (714) 625-5450

DEMO DISK AVAILABLE!

DataFast Software, Inc.

Satisfied with your billing software? We specialize in billing software which interfaces directly to your paging system. Current versions available for the Spectrum Paging System. Other versions available by request. Features include auto pager programming, callcount billing, one step data entry, multiuser, and much more. Non-Interface versions and lease options available. Call or write for details.

DataFast Software, Inc.

105-F Dunbar Avenue
Oldsmar, FL 34677
1-(813) 854-4911
1-(813) 855-2851 Fax



Equipment wanted

WANTED

Used GE Trunked Mobiles and Stations
TMX-8210, TMX-8310, TMX-8510,
GE-MARC V Stations.
Call John Peacock
800-232-7715

WANTED TO BUY

LB, 70, HB, UHF, 800 T.C.
BASES, REPEATERS, TEST EQUIPMENT
MICROWAVE, DUPLEXERS, MOBILES
UHF SPIRITS, UHF PULSAR II

- Turn your surplus/idle equipment into working capital.
- Idle equipment is worth less everyday it sits unused.
- Make a list of your equipment and CALL OR FAX TODAY!!!

VERSATEL pays CASH, finder's fees, and trades equipment.

VersaTel

1-800-456-5548 Fax 307-266-3010

Equipment Wanted

Motorola, Johnson, GE, EFJ, Uniden, Standard

Buy-Comm-Co.

1-800-347-4121

FAX (602) 395-1357

WANTED 35 MHZ PAGERS

WANTED 35 MHZ

MOTOROLA

Transmitters, PURC/Compa

1-800-638-9969

Ask for Ext. #18

Equipment for sale

HAVING AN IDENTITY CRISIS?



FELIX SEZ: LET US FIX IT!
LABELS & NAMEPLATES
FOR
PAGER, RADIO, CELLULAR

also REWARD LABELS
Your Logo and Company ID Imprinted
• No Minimum Order • No Set Up Charges
Send For Free Samples

ADVANCE LABEL & TAG
1725 N. McDonald McKinney, Texas 75069
1-800-777-9794 FAX(214)548-2518

2-WAY RADIO
OPERATORS!

one of IMCE's
10 most innovative
products!

**SAY
GOODBYE TO
DEAD AUTO
BATTERIES!**

The ChargeGuard™ automatic timer switch for 2-way radios extends vehicle battery life by automatically switching your radio on and off. Complete & easy to install. Nothing else to buy!

- rugged, dependable
- programmable
- no ignition switch connection
- actually warns of electrical system problems!
- made in the USA! patented!

Only \$79.95 list! Order toll-free today!

CHARGE GUARD™
automatic on-off switch for 2-way radios

800/458-3410

ChargeGuard Corporation, 400 Highland Ave., Allentown, PA 18002
(US Patent 4,900,913)

Circle (127) on Fast Fact Card

**BUY - SELL
RADIOS
NEW & USED**
Johnson - Motorola
Standard - Uniden
Buy-Comm-Co.
Steven Kenney
1-800-347-4121
(602) 870-4121
FAX (602) 395-1357
2340 W. Columbine
Phoenix, Arizona 85029

The MOTHER of all Miscellaneous Sales!

PORTABLE GOODIES:

MT500 Convertacam, Consoles only. \$25.
MX 1 hour Rapid Chargers, NLN858, \$49.
MT500 12 unit Omni Rapid Chgr, \$425.
MT500/H1220 Nicad Tester, Mod. TEK48, \$75.
MT500 Test Cable assembly, RTK4001, \$19.
MX Battery Eliminator, Hooks to P.S. \$49.
MX Nicad Tester, \$117, \$59.
\$2,000+ in new H1220 case parts. \$395.
Box of 40 nice leather & urethane cases, \$99.

PAGING, ETC:

Paging encoders, N1016-1019.Ok. w/reeds. \$14.
Non Mot. Touch Tone pad, new. \$19.
Modem 36 page encoder Super \$145.
Modem 100 page encoder Super \$275.
Q1877A Phone patch in 31" Compo cab. \$695.
Modax 100 E08DAL01008G, w/L.D. \$495.
Modax 500, loaded & mint! \$695.
Modem PLUS. E08PLS2000BL Encodes ALL! \$795.
System 90 paging decoders. \$15.
Page encoder. 870 call cap. w/reeds. \$149.

TOTALLY MISCELLANEOUS:

Box of Motrac parts & boards. Some new, \$39.
Box of 23 12v horn relays. \$9-812674. Used. \$46.
Box of 14 NEW relays as above. \$70. or \$6. ea.
Box of 33 xtal ovens. 6 pin for Motrac. \$9.
TLN5907 2 piece adjustable brkt, for ??, New. \$5.
Several HUNDRED used mobiles & bases. CALL!
Complete set of outdoor cab, vents, used. \$49.
Lot of 20 Andrews heliox conn. some new. \$85.
Nakamichi TD700 car stereo. L. \$695. Sel. \$375.
Pulsar II new junction box kit. TLN2366, \$99.
Lot of 23 brn METRIK good used cases. \$15.
Syst. 90 quick call kit, NEW! W/reeds. \$65.
Lot of mobile phone parts/kits. 80% off NSOI!
Altos multi-user computers. Perfect. Boths=\$1500.
Logging rdr. ECHO-1. List \$3000. Sell \$495.

CALIFORNIA RADIO™

16943 - 6200 Road
Montrose, COLORADO 81401

ACCESSORIES:

Micor mikes. Brand New. TMN6054, \$49.
Macom 70 mikes. Brand New. TMN6013, \$45.
Micor cables. Brand New. TKN6454, \$79.
Mitrek 10 watt spkr. Brand New. HSN4009, \$25.
Syntor speaker. Brand New. \$25.
New Micor control head. 4 Iq. TCN1096, \$65.
Lot of 28 Mot. handsets. Micor/Mo. 70. \$120.
Locking brackets for Maxair 80 & Moxy. \$9.
System 90 cases. As removed from service. \$1.
Large trunnion brackets. 7-84809801, \$2.
System 90 boards. Any, except scan. \$15.

TEST EQUIPMENT:

P2001 System Analyzer. Great shape! \$6,900.
MODAT test set, NSO over \$4,000. Sell. \$399.
Base station extension cards. TLN8799, \$4.
RCA Signal Gen. WR-50B. 85 KHz-45 MHz. \$45.
Portable test set. \$10568. W/3 cables. \$179.
Bench supply. Astron RMS50M. 50 amps. \$185.
BIRD Wattmeter. Model 43. No slugs. NEW! \$99.
300 W dummy load. Decibel Mod. DB4304-B \$99.

PARTS:

Micor PL boards. Xmtl or Rec. Anyl \$19.
PL reeds for any Motorola unit. \$19.
\$140,000. in Mot. parts. 50% off NSOI! List \$10.
5894 final tubes. Never installed! \$99.
8643 final tubes. Never installed! \$129.
4057/8052 final tubes. Never installed! \$159.
PK701, 705, 779, 780, 781, 786 & 787. 1/2 NSOI.
Lot MX new parts. Knobs, escut., fuses etc. \$149.
DPL chips. Programmable by punching. \$4.
Syntor interconnect pcb. HLN4109B. new! \$55.
Lot of 12 non-Mot. pl boards. Programmable. \$96.
Lot of 63 in pkg. new MX fuses. 65-139554, \$63.
Lot of 55 H1220 type fuses. 65-82896803, \$25.
Lot of 12 H190 type new fuses. 65-82896807. \$7.

Orders: 800-231-0103

All other calls: 303-249-1414

24 hour FAX: 303-249-4334

Call US for RADIUS! We'll BEAT your best deal!

Replacement Batteries

Centurion's full line of batteries to fit leading models perfectly.

For Two-Way Radios and Cordless Telephones

- Motorola ■ GE ■ Uniden ■ Maxon ■ King
- Midland ■ Cobra ■ AT&T ■ Radio Shack ■ Sanyo

For a distributor nearest you, please call

Toll Free 800-228-4563; or toll free fax 800-848-DUCK (3825)

CENTURION
INTERNATIONAL, INC.

P.O. Box 82846 ■ Lincoln, NE 68501

Circle (128) on Fast Fact Card

**GE 2-WAY RADIO
WHOLESALE
DISTRIBUTION CENTER**



D&L CONNECTIONS
• Less than wholesale prices
• One million dollars of GE equipment
• Same day shipping
• Express Repair power
ASK FOR 1-800-336-6825
A DIVISION OF D&L COMMUNICATIONS, INC.
3512 CAVALIER DRIVE • FORT WAYNE, IN 46808

Circle (129) on Fast Fact Card

Pagers and parts

Reconditioned or As Is

Motorola and NEC

We also have new and used parts for pagers: Batteries, vib motors, cases, code plugs, reeds, filters, etc.
Call today for your pager needs

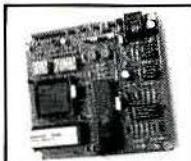
We buy pagers

McManus Communications

(501) 763-6250

FAX (501) 763-6533

Natural Voice Playback



- Repeater Identifiers
- Site Alarms
- Remote Telemetry
- Weather Stations
- Multiple Languages
- Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies consisting of over 100 words or multiple phrases up to 1 minute in a *Natural Voice* is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

Parallel input word select 8 ohm Audio output
500 ma keyline output output 600 ohm Audio
32 Kb sampling rate +9v to +14v supply
Multiple modes Size: 4.00" x 4.25"
Selectable timing Connectors included

Several different models available

Palomar Telecom, Inc.

300 Enterprise St., Suite E • Escondido, Ca. 92025
(619) 746-7998 • Fax (619) 746-1610

ULTRA-COM 96



Desktop dispatch console expands to 16 channels

- LOW PRICE
- BIG SYSTEM PERFORMANCE
- DYNAMIC PROGRAMMABILITY
- MICROPROCESSOR CONTROL
- MULTI-FORMAT PAGING
- MANAGEMENT REPORTS
- PERSONNEL VEHICLE STATUS
- G-STAR INTERFACE
- E-911 COMPATIBILITY

MODULAR COMMUNICATION SYSTEMS

13309 SATICOY ST.
NORTH HOLLYWOOD, CA 91605
TEL. 903-860-3660 FAX 903-860-3658

Circle (131) on Fast Fact Card



Antenna Farm

11500 W. 90th St. • Overland Park, Kansas 66214
913-492-6212 FAX 913-492-2948

Cable • Connectors • Antennas • Installation Equipment

Selectone

- Tone Signaling Products
- Remote Control Accessories
- Voice Encryption

3 Decoder models for mobile selective calling and an exclusive 28 pin DIP DTMF sequence decoder module.

LOW PRICES • 1-800-255-6222 • FAST DELIVERY

Circle (130) on Fast Fact Card

FOR SALE

GE 100W VHF MASTR II	\$135 ea.
GE 50W VHF MASTR II	\$75 ea.
GE 100W LB MASTR II	\$135 ea.
GE Delta-S 100W LB W/ACC	\$350 ea.
MICOR 45W VHF T43RTN1190	\$65 ea.
MITREK 50W LB	\$135 ea.
MX-360 VHF 6W W/PL	\$150 ea.
GE PL BOARDS	\$25 ea.
BIRD METERS MODEL #43	\$140 ea.
MICOR SCAN HEADS	\$25 ea.
GE MASTR II CABLES & HEADS	\$20 ea.
GE MASTR II SPEAKERS & MICS	\$15 ea.
MICOR CABLES & MICS	\$15 ea.
MICOR HEADS ... \$20 ea. SPEAKERS	\$15 ea.
OKLAHOMA TWO-WAY 405-528-6467	
VISA—MASTERCARD—DISCOVER	

UAI-10 AND UAI-20 UNIVERSAL REPEATER/LINK AUDIO INTERFACE



Detailed application manual

Low power operation, 19ma @ 12v
CTCSS decoder on the UAI-20 only

Assembled, tested, one year warranty

Link monitor-mix/monitor mute control

Adjustable repeater/link/DTMF audio outputs

Selectable DTMF mute on repeater and link audio
Repeater, link, auxiliary and control audio inputs

UAI-10 UAI-20
\$44.00 **\$89.00**

CREATIVE CONTROL PRODUCTS

3185 Bunting Avenue
Grand Junction, CO 81504
(303) 434-9405



MOTOROLA RECONDITIONED RADIOS HUNDREDS IN STOCK

800-231-0103

CALIFORNIA RADIO

MICROWAVE SALE

2 GHZ FARINON SS 2000T-2
6 GHZ MOTOROLA MR 600
24 and 48 VOLT CHARGERS
HP-3336B SYNTHESIZER
LEVEL GENERATOR (NEW)

818-308-0398

FAX 818-308-3909

Equipment for sale

GENERAL COMMUNICATIONS

MOBILE COMMUNICATIONS
AUTHORIZED DEALER

#1 GE DEALER IN THE USA!

Largest Inventory — Quality Service

Fastest Delivery and Best Prices



1-800-356-3200

5157 Anton Dr.
Madison, WI
53719

Circle (132) on Fast Fact Card

CRYSTALS FOR ALL RADIOS

Communication Crystals

All makes and models

Channel Elements

Recrystallized and compensated

COMPETITIVE PRICING!

Emergency Service

For Crystals: 24 Hours 72 Hours 1 Week

Normal Delivery 3 Weeks

800-333-9825

CAL CRYSTAL LAB, INC.

1142 No. Gilbert Anaheim CA 92801 • FAX 714 491-9825

Swersweep

SWR Measurement Kit

Swersweep is designed to work with modern service monitors with tracking generator and spectrum analyzer enabling a plot of SWR vs. Frequency on the CRT display. Swersweep allows the instrument to function as a scalar network analyzer. See feature article on page 64 of October 1989 *Mobile Radio Technology* for more information.

Uses:

- Tuning Antennas: Base, mobile, or glass
 - Tuning cavities, duplexers, or filters
 - Tuning preamps and Receiver front ends
 - Checking transmission line and trimming to resonance
- Each Swersweep is hand built with calibration traceable to the National Bureau of Standards.

1-500-MHz \$350, 1-1000 Mhz, \$675

Prices include shipping.

Europa Marketing

2358 S. Patterson Mesa, AZ 85202

Phone: 602-345-6666

Hy-Q

International

- Communication Crystals
- Pager Crystals
- Channel Elements
 - Recrystallized
 - Compensated
 - Complete Elements

48 HR. SERVICE AVAILABLE

(606) 283-5000

FAX (606) 283-0883

1438 Cox Avenue

Erlanger, KY 41018

(Greater Cincinnati Area)

Precision Quality Quartz Crystals
Made To Your Specifications

Circle (133) on Fast Fact Card

BUY — SELL — TRADE

Micor Base/Repeater from \$1295

Master II Base/Repeater from \$1295

Mocom 70 Consoles from \$250

Mocom 70 Mobiles from \$100

Micor Mobiles from \$150

Mitrek Mobiles from \$150

Maxar, Radius, Traxar Mostars from \$150

Master II Mobiles from \$150

EX II Mobiles from \$100

Phoenix/Centura/MVP from \$150

DC/Tone Remotes from \$100

Pulsar II/III VHF/Bell from \$395

Bases/Repeaters/Mobiles

No Used Pagers-Portables or Parts

Cash + Shipping Paid Promptly

Call For Quote or Sales List

Office (Nat'l WATTS) 1-800-423-3858

Warehouse 1-501-835-7066

BARNETT ELECTRONICS

8718 Wilhite Lane • North Little Rock, AR 72120

VersaTel

COMMUNICATIONS BUY-SELL-TRADE

40w Exec II UHF Base

40w Exec II VHF Base

100w Micor VHF Mobiles

45w Micor 90 VHF

45w Micor UHF

30w Maxar 80 UHF

30w Maxar 80 VHF

30w More VHF RRC

30w Mitrex VHF

30w Mitrex UHF

30w Maxar 50 UHF

100w Maxar 10 UHF

100w Maxar II VHF

40w Exec II UHF

100w Exec II UHF

30w Phoenix SX VHF

★ ★ SPECIALS ★ ★

- GE EXEC II 40 Watt VHF mobiles w/acc. \$89.00 **
- Uniden FTU-500K UHF 50W. 36 CH Synth. \$249.00 **
- GE Exec II 20 Watt UHF Repeater/Base \$395.00 **
- Pediocode DTMF Microphones. W/Schematic \$18.00 **

1-800-456-5548

DON'T FORGET

THE MOST IMPORTANT PART
OF YOUR PAGER, YOUR LABEL.

QUALITY PRODUCT

AFFORDABLE PRICING

CUSTOM SERVICE

FAST TURNAROUND

ANCHOR GRAPHICS

1467 LeMAY, CARROLLTON, TX 75007

BUS: (214) 242-0439 FAX: (214) 242-0959

FOR SALE

GE Delta S N3HH1N060TA Synthesized 150-170 Range 60w

w/acc. (C800 Head) \$298

GE Exec II RT56FFU66 150-170 range w/acc. \$135

GE Porta Mobile II HH56SASAGX 20w 138-150 range \$68

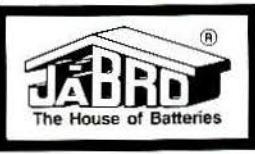
Mot Micor T34RTA3600 450-470 range w/acc. \$150

MOT MOCOM 35 P43CCN3100A 30w 150-170 range \$58

PEKAAR COMMUNICATION INC.

Call 201-772-0704

If you can't find it—call us.



**... Your Best Source
For High Quality
Communication Batteries**

Offering the finest quality rechargeable nickel cadmium replacement batteries with *the best warranty in the industry* for: MOTOROLA

- GENERAL ELECTRIC • MAXON • REGENCY • WILSON • REPCO
- RCA • RITRON • ICOM • STANDARD • HENRY • KENWOOD • KING
- JOHNSON • MIDLAND • YAESU, as well as custom assemblies.

JABRO Batteries, Inc.

1938-A University Lane, Lisle, IL 60532
Phone: 800/323-3779 • FAX: 800/237-6435

Circle (134) on Fast Fact Card

USED 2-WAY RADIOS

Call Sid Cohen

at AIR COMM—Phoenix, AZ
(602)275-4505 • Fax (602)275-4555
 30%-70% savings on Motorola, GE, EFJ mobiles,
 base stations, portables, pagers, repeaters—
 primarily solid state—all frequency bands. Also,
 accessory items: Motorola "Systems 90" control heads.
PL and paging reeds, channel elements.
 Cash quotations made for purchase of above equipment.



4614 E. McDowell Rd.
 Phoenix, AZ 85008

UNtenna™

*Low Profile Antenna for
 Cellular Phones*

Fully Tunable, CR89AGP
 800-900 MHz Antenna

FEATURES: • Built-in ground plane that allows for *Inside The Vehicle Mounting* or mounting on fiberglass vehicles.
 • Low Profile- Only 2.5" H x 4.5" Dia.
 • Total Rigidity-Eliminates "Picket-Fencing"
COM-RAD INDUSTRIES P.O. Box 554
 Grand Island, NY 14072-0554
 Free Brochure • Phone: 716/773-1445

Circle (135) on Fast Fact Card

The talk of the town.....

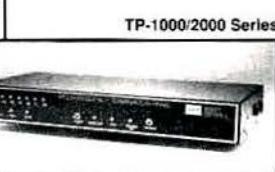
**Voice
 Announced
 Channel
 Identification**

The TP-1000/2000 features:

- FSK
- Activity monitor leds
- Function / channel leds
- Software control
- Rack mountable



RT - 40/80 Series



TP-1000/2000 Series

AEE's newest multifrequency termination panels TP-1000 (4 frequency) and the TP-2000 (8 frequency) are the talk of the town. Select a channel on our multifrequency tone remotes (RT-40 and RT-80 series), interfaced to our new termination panel, and the remote not only displays the channel; but, it vocally identifies itself via our new microprocessor controlled synthesized panel. The panel also tells a remote when another remote has switched transmitting channels.



Automation &
 Electronics
 Engineering, Inc.

13667 Floyd Circle • Dallas, Texas 75243
 (800) 527-4596 • (214) 238-9596 • Fax (214) 238-9181

Circle (136) on Fast Fact Card

Channel Elements

100,000 Freqs in Stock!

MITREK, MASTR II, MVP, EXEC II
 MICOR, MOCOM & MOTRAC

\$15 w/trade or \$25 w/o trade

Lifetime Warranty

3-Day Standard Delivery

1-800-237-9654

CHANNEL ELEMENT HQ.

4120 Kirby Road
 Cincinnati, OH 45223

We Buy Channel Elements.

**MOTOROLA
 CENTRACOM I & II**

Console components

BOUGHT & SOLD

**Telecommunications
 Engineering Associates
 409 Wildwood Dr.
 So. San Fran., CA 94080
 Ph: (415) 871-4200**

Circle (137) on Fast Fact Card

GE GE GE GE GE GE
 BUYING USED GE EQUIPMENT
 CALL OR FAX FOR QUOTE

FOR SALE

Motorola MICOR 45W UHF w/acc	\$135
MASTR II UHF/VHF RPTR & BASE . Call	
Delta-S 42-50 w/acc. new	599
Delta-S 42-50 no. acc. used	275
Delta-S 150-174 no. acc. 110W	295
Delta-S 494 90W 128 ch new	699
MASTR II 150-174 no acc. 110W	115
Crystal Phoenix w/acc mint	165
D5A01 GESTAR decoder new	275
S-700 weather proof scan control with all accessories new	225
S-990 128 ch control head	125
S-950 128 ch control head	75
C-800 scan control head	12
C-900 scan/multi CG encode	35
MPS/MPR/MPX/MPI/MPD Chargers . Call	

NEW LONDON TECHNOLOGY
 231 Old Timberlake Road

Forest, Virginia 24551

TEL 804-525-0068 FAX 804-525-0078

RADIUS
 WE'LL BEAT YOUR BEST PRICE!
 California Radio 800-231-0103

ATTENTION

Maxon & Other Profit Motivated Dealers!! AIR COMM has acquired MAXON UHF telemetry data and voice portable radios (Model CP0530). They can be used either for voice on the 12.5KHz offset (T/R 464.6375 MHz) or for telemetry transmission using a hand-held Computer/bar code reader (and SCADA application) using a Universal Data Systems P/N54965010, "HPM-R" modem W/P/N PJ20851 interconnect cable.

Model CP0530 (2W, 1F, C/SQ) +75 Model CA110, 1-Unit, dual rate charger \$20 US\$ "HPM-R" Modem w/Cable—Make offer. Quantity Discounts Available.

**Radio Interface Box
 MOTOROLA RADIO
 Programming Adaptor
 (PA-1)**

Computer Interface Box, replaces 01-80353A74, HLN 0214A, RLN 4008A boxes, box packages includes: AC wall power cube, "XT" or "AT" interface cable \$90

RADIO CABLES
 "P-200", "HT600",
 "MT1000" \$65
 "P-100", "HT50" \$80
 "SABER" \$125
 "STX" \$35
 "Spectra" \$50
 "MAXTRAC", "M100",
 "MERATRAC" \$35

Note, these products are NOT manufactured by MOTOROLA. They are fully compatible.

IMTS TERMINAL — FINAL CLOSE OUT

Hark: Model: AMT-2 \$1500
 Central Processor \$250

Glenayre: IMTS Encoder/Decoder
 Logic Unit \$75
 (GL20410)
 Quantities Limited

AIR COMM

4614 E. McDowell, Phoenix, AZ 85008
 602/275-4505 Fax: 602/275-4555

Plus, we stock all types of paging, "PL" and "DPL" reeds, code plugs and filters at LOW PRICES.

Circle (138) on Fast Fact Card

Equipment for sale

**COOKS
COMMUNICATIONS
CORP.**
 (Authorized Dealer)
GENERAL ELECTRIC
 Mobile Radio

GE MOBILE AND PORTABLE RADIOS AT WHOLESALE PRICES

160 N. BROADWAY
FRESNO, CA 93701

1-800-233-8818



"HOT" SUMMER SAVINGS AT C.W. WOLFE!

BASES/REPEATERS

MOT MICOR CS3RTB1103	\$700.00	MOBILES	GE MASTR II UHF, 100 watt	\$490.00
H.B. Local Control (like new)		ACCESSORIES		
1 MOT Micor C64 Repeater Cont Duty	\$3000.00	MASTR II Access. Group		\$100.00
		MISCELLANEOUS		
MOT MICOR, 45W, 8 F.		GE PE 3 Hour Rapid chargers		\$65.00
136-150 MHz drawer unit only	\$65.00	Radicode DTMF Mic's. MITREK,		
with all access... no mike 2 F.		MICOR, SYNTOR Plugs		\$20.00
Scanned		25-MOT MC-70 Front Mt. control		
4 Frequency, with scan, no mike	\$120.00	Heads		\$20.00
40 GE Century II all access		12 HT 220 12 pocket wall charger		\$70.00
20 H.B. MVPs, clean, all access	\$225.00	20 MVP Power Supplies w/remote		
GE Mastr II UHF 40 Watt all access.	\$375.00	& mike		\$125.00
GE Delta "S" VHF 40 Watt 16 ch.		Fedora PA-2D Interceptor,		
w/CG, all access	\$285.00	100 watt, Slave Amp		\$50.00
MOT MT 500 VHF & UHF AF & BF w/PI	\$125.00	CALL FOR CURRENT FLYER		
MOT PT 500 VHF CSQ, 4F & 8F	\$125.00			

CW-W
COMMUNICATIONS

All sales cash or cashier's check. Fax: (406) 252-9617
1113 Central Ave. • Billings, MT 59102 406-252-9220

USED PAGERS

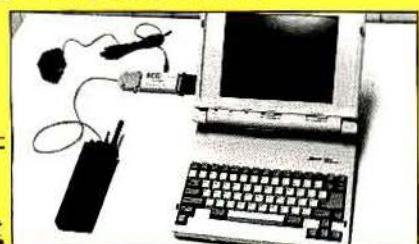
Motorola and NEC. Reconditioned on
your channel w/warranty or as is.

ACS (303) 337-4811
FAX (303) 337-3084

MOTOROLA RADIO Programming Adaptor (PA-1)

Full line of radio programming cables available

- IBM AT/XT compatible
- Program your radios "IN HOUSE"
- Programs: Radius, HT600, STX SABER, Maxtrac, MT1000, etc.



SCC
 Southern Computer Corp.
 141 W. Wieuca Rd.
 Atlanta, Ga. 30342
 FAX (404) 252-8929
PA-1 ONLY \$169.00

Circle (139) on Fast Fact Card

FOR SALE
 VHF Micor Repeater, w/duplexer
 110w 41" Cabinet. \$2400.00
 (919) 662-8083 After 6 p.m.

SWEPT SWR MEASUREMENTS The Easy Way!

Uses modern return loss bridge method.
 Highly directive: long cable runs no problem.
 Low cost: 5-1000MHz, 45 dB \$329.00.
 Interested??... See ad on page 102.
 Free application note: "Swept SWR Techniques"
 Call: (316) 942-5100 for catalog & ap note!

PORTABLE RADIOS



MINICOM

PROFESSIONAL HANDHELD VHF FM TRANSCEIVERS 2 WATTS - TWO CHANNELS

Ideal for use on construction sites, in factories, for security control, and by recreational supervisors.

FEATURES INCLUDE:

- Range up to 3 miles, subject to environmental conditions
- Lightweight, compact, sturdy high impact plastic textured case, with belt clip and carry case.
- Rechargeable nickel cadmium battery pack, A.C. battery charger, flexible antenna with BNC connector, FCC license application included.
- Jacks for A.C. charger, earphone, external speaker/microphone, and external antenna with BNC connector.
- Two-channel selector switch.
- Volume control/power on-off switch.
- High/low transmit power output switch.
- Adjustable squelch control/tone squelch on-off switch.
- Battery/transmit LED indicator.
- Operates on any FCC Part 90 radio service frequencies.
- Available in three business band frequencies:
 FREQUENCY A - 151.625 MHz (RED)
 FREQUENCY B - 154.570 MHz (BLUE)
 FREQUENCY C - 154.800 MHz (GREEN)
- Includes set of installed crystals for one of above selected frequencies in channel 1. Optional set of crystals can be installed for channel 2.



Circle (140) on Fast Fact Card

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR

\$25 - \$35!!!

ORDERS ONLY:

1-800-237-6519

INQUIRIES AND IN LA:

504-361-5525

- Motrac; Micor, Mocom; Mitrek; Etc.
 - MT's, and GE Elements. Call for prices.
 - Any desired Frequency available for fast delivery.
 - Lifetime Warranty on Crystals
 - Trade-in credit on your Old Channel Elements
 - We Buy Used Elements
- Try us first. We always have your frequency available.

NKX
 1814 Hancock St.
 Gretna, LA 70053



Classified

Equipment for sale

CHANNEL ELEMENTS REBUILT

- Lifetime guarantee on Bomar Crystals
- Competitive pricing
- 48-hour, 1-week and 2-3 week service

CALL 800-526-3935 FAX 800-777-2197

IN NJ: 908-356-7787

BOMAR

201 Blackford Avenue • Middlesex, NJ 08846

Circle (141) on Fast Fact Card

CLEAN MOTOROLA RADIOS

MOBILES

35 W Syntor X2 or X3 trunked 800 MHz	\$395
12 W & 30 W Spectra 900 MHz trunked from	\$595
15 & 35 W Mostar trunked 800 MHz from	\$395
15 W Maxtrac trunked 800 MHz will program	\$595
25 W Maxtrac UHF 16F scan will program	\$495
30-50 & 100 W UHF Mitrek 4 F PL/DPL from	\$295
50 W Syntor UHF 8 F PL New ACC	\$395
100 W UHF & VHF Maratrac A-7 99F Scan	\$1,095
100 W UHF & VHF Syntor X 16F New	\$995
100 W Micor UHF 12F PL WST Reconditioned	\$195

PORTABLES

4 W HT90 2F PL UHF —New NI-CAD & Antenna	\$225
5 W MX-S 340 & MX 350 PL UHF —As New From	\$195
2 W MTX810 Trunked 800 MHz NI-CAD CHRGR	\$695
2 W MTK900 B4 Trunked 900 MHz CHRGR TELE	\$895
3 W STX Trunked 800 MHz Tel Interconnect CHRGR	\$695
5 W VHF HT600 6F Will Program as new	\$495
4 W HT440 UHF 4F PL	\$295
6 W SABER 1-12F VHF DVP Will Program	\$995
1 W Expo UHF 2F PL New Battery	\$295

BASES

100 W UHF MSR2000 w/PL	\$3,495
25 W UHF Flexar DPL W/handset	\$395
25 W Motrac UHF Consolette PL MIC	\$125
50 W Mitrek UHF Consolette PL Remote	\$595
12 W Spectra 900 MHZ Trunked	\$995
15 W Maxtrac or Mostar 800 MHz Trunked	\$995

NEW RADIUS RADIOS

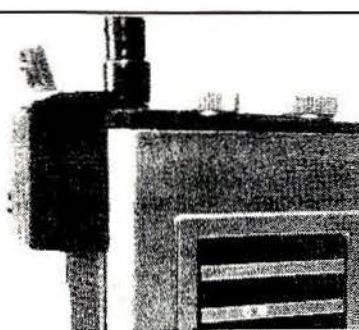
M-100 25W 2F VHF	\$399	25W UHF	\$458
M-100 45W 2F VHF	\$464	40W UHF	\$523
M-100 100W 99F Lo-band, VHF or UHF	\$1,095		
P-100 5W 2 CHAN VHF	\$451	4W UHF	\$483
P-200 5W 2F VHF	\$530	4W UHF	\$595
P-50 5W 1F VHF	\$334	4W UHF	\$344
		Lo-band	Lo-band
		\$376	\$376

WE BUY LATE MODEL MOTOROLA

PORTABLES & MOBILES

RADIO EXPRESS, INC. 703-266-1928
P.O. BOX 632, CENTREVILLE, VA 22020

Circle (142) on Fast Fact Card



MX320-360 Antenna Adaptor

Allows for quick and secure attachment for external antenna or test equipment. Terminated in BNC. \$10.00 shipping additional.

METROCOM SERVICES
35-30 38th Street
L.I.C., NY 11101
(718) 392-3300

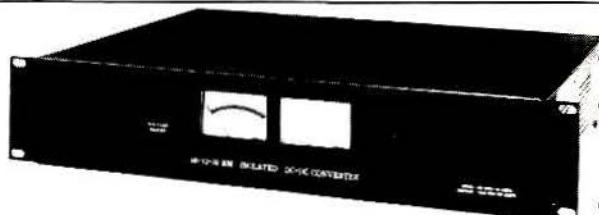
Circle (145) on Fast Fact Card

SERVICE MONITORS

Specializing in Service Monitors since 1973

- Repair and Calibration
- Buy, Sell and Trade

COMMUNICATION INSTRUMENTS
356 Hillcrest Street, El Segundo, CA 90245
Phone (800) 288-8223 or (213) 322-3666



distributed by

NEWMAR

Communications Associates Inc.

(800) 435-9313

In Illinois (800) 892-1611

Order Fax (800) 284-4934

Circle (143) on Fast Fact Card

MECHEM ELECTRONICS

P. O. Box 7846

Fredericksburg, VA 22404

(703)373-3888

Visit our shop at 1005A&B
Tyler Street in Fredericksburg.
Direct all correspondence to our
P.O. Box.

Portables

T1005P1010 & T1011 PX300 Pack Sets VHF Range 10W
HN56SEMEHX GE PMII 4F CG TX 150-174

H338BU3184 AMT500 UHF 8F PL 4W

P24ESN3150ASPI APCOR EMS Portable AC/DC Chargers

Multi FXL Portable Rptr VHF

H44SSU3140AN MX300S UHF PL 6F 5W

Mobiles

T71RTN3490B 100W, PL 36-42/42-50 sub bands

T51 and T81JJA3900PL 39-50MC Mitreks

T64SR3800BK UHF Syntor PL 450-470

Mastr II's UHF & VHF

Microm and Triton HF SSB transceivers

T53 and T73 RTN 3100 PL Micors 4 & 8F Scan etc.

T53 & T83 JJA 3900 PL 148-174MC Mitreks

T83VXJAKSP01 DVP SyntorX 110W w/EE PROM
T83SRA320DAK Syntor 150-162 110W w/system 90 acc.

EMS Memcom full duplex

D43JMA3300AK MOXY VHF 45W 2F PL

Bases

C34RCB1106 12W Micor Control Station 450-470/494-512MC

C73RCB1106 and 3105 Micor VHF Rptr Full Filter & shielded

DC76TCU66A Mast II 150-174, 110W, 2F CG

DC76TF566A Mast II 150-174 110W, 4F CS

MSR2000 VHF 100W Cont. Duty Tone Remote

L73JJB1136BB Mitrek 110W 148-174MC Tone Remote

C53RTB3125C Micor 60W PL 150.8-162 Remote Control

C71RTB3493DM 42-50 PL 4F Local Control

HT's, MT's, MX's and Accessories, Spectra Tac Equipment

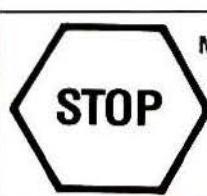
Call or Write for our Spring Flyer.

Circle (144) on Fast Fact Card

Dual Control Head Adapter for EFJ Challenger Mobiles

Mark Bitting Inc.

P.O. Box 13; New Cumberland, PA 17070
(717) 774-7203



MOTOROLA RADIUS
End users shop first then call for best price.
Procomm
805-497-2397



Equipment for sale

MOTOROLA Radius DELIVERY NOW!

Every Model in Stock! Free Programming of all new units on Delivery!
Will Positively Be Shipped Tonight!

On your jobsites tomorrow. We can handle any size order and have
done so for 18 years.

**CALL 1-800-53-RADIO (72346)
FAX (404) 568-4506**

To place your order, even if you live in Hawaii, Virgin Islands, Alaska or
Puerto Rico. **RADIO WHOLESALE - John Cunningham WB4-JUN.**
One of the largest stocks of Motorola Radius in the world.

Circle (146) on Fast Fact Card

ACTIVE FILTERS AND REEDS

FOR MOTOROLA PAGERS
FAST DELIVERY

Bramco.

PH (513) 773-6255

P.O. BOX 1482, PIQUA, OHIO 45356

ARIZONA TWO WAY COMM.

MX BATTERIES "NEW" 3½" \$ 20.00
T44RTN190 MICOR T/R UNIT 45W. \$ 20.00
450-470 \$ 60.00
TLE-8423A EXCITER MICOR 450-470
W/45W PA \$ 40.00
TLE-6433A EXCITER MICOR
WIDE SPACE W/LOW AMP \$ 50.00
TLE-8032A RECEIVER MICOR
450-494 MHz \$ 40.00
G.E. VHF MVP RADIOS 4 FREQ. W/PL \$ 75.00

**BUY * SELL * TRADE
(602) 624-8200 * LARRY**



NEW!! NEC IDP5000 Pagers

Stocking common RCC and PCP frequencies

Why wait for your pagers

Call before 12:00 noon CST
for same day shipping. **NEC**

McManus Communications
501/763-6250
FAX: 501/763-6533

USED RADIOS at Low Prices!

- MICOR
- MITREK
- PORTABLES
- MOCOM 70
- MAXAR
- RPTRS.
- GE
- RCA
- ACCESSORIES
- TONE ELEMENTS
- CRYSTAL ELEM.
- BASE STATIONS

Large Quantities • (817) 433-5452

**Make your
classified
ad**

**STAND
OUT!**

**Use
COLOR!**

ICOM
Sales and Service
800-SPOT-CRIME
SWS Security

For Sale
Centra Com I
Centra Com II
-Whole or in Parts-
Centra Com II
Reprogramming and
Custom Changes
Northeastern Communications Inc.
Waterbury, CT 06705
(203)575-9008

\$PECIAL\$ \$PECIAL\$ \$PECIAL\$

MOTOROLA SERVICE MONITOR R-1200, CALIBRATED
W/90 DAY GUARANTEE WISCOPE, CODE ENCODER,
MIXER

Quantity	Price
UHF PORTABLE ANTENNAS W/BNC (LOTS OF 60 @ \$150)	call
MTX800-810 Portables	call
1) C75HCB 800MHz Rptr	call
10) D27KGASJB2 Spectra 900MHz	call
10) D35MQASGB5 MaxTrac 800MHz	call
10) D35TDA-TLA Mostar 800MHz	call

Leavitt Communications, Inc.
708-674-1799 FAX: 708-676-8860

**WE BUY AND SELL USED MOTOROLA
AND GE FM TWO-WAY RADIOS**

3 SYNTOR X 800MHz, TRUNKED, T45VSJ5G00
1 MICOR BASE, 800MHz, L35RTB6000
27 MICOR, 800MHz, T45RTA6000
37 MICOR, 495MHz, T74RTA3000
1 MSF5000 BASE, 460MHz, C74CLB7106
4 MOTRAC COMM Rptr. 460MHz, C74MSY3101T
17 MITREK, 460MHz, T74JJA3000
30 MICOR, 460MHz, T74RTA3000
7 DUPLEXER, 403-512MHz T1504
2 SYNTOR, 155MHz, T63SRA3200
17 MITREK, 153MHz, T83JJA3000
200 MICOR, 153MHz, T73RTN3100
24 MT500, 153MHz, H33BBB3184
10 GE MASTR EXEC II, 48MHz, SX74AAN33A
8 MITREK, 31MHz, T81JJA4900 (NEW)
8 MAXAR 80, 31MHz, D51TSA4000
8 MOXY 31MHz, D31GMA4000
77 MOCOM 10 31MHz, D41AAN3100
8 Y1600 REMOTE CONSOLES, TONE & DC MIXED

SCHAEFER RADIO CO.

1301 Grant • Box 395 • Denver, IA 50622
319/984-6115 or FAX (319) 984-6220

MOTOROLA Mobiles & bases

(All 100% bench tested & reconditioned!)
Remember, you get what you pay for!!

Low Band mobiles:

Maxar 80, ext. recased, 55 w., 30-36 \$295.
Mitrek, pl/dpl, 4 ch., 60 w., 30-40 \$495.
Mitrek, pl/dpl, 100 w., 40-50 special \$495.
Mitrek, pl/dpl, 4 ch., 100 w., 30-40 \$875.
Mitrek, pl/dpl, 4 ch., 60 w., 40-50 \$495.
Maxar 80, pl, recased, 55 w., 42-50 \$295.

High Band mobiles:

Moxy, pl, 2 ch., 45 w., 150-160 \$249.
Mocom 70, pl, 4 ch., 110 w., Mint! \$395.
Micor, pl, 4 ch., 110 w., 150-160 \$475.
Radius, used, 2 ch., 25 w., 150-160 \$195.

UHF & Trunked mobiles:

Mocom 70, pl, MINT, 25 w., 450-470 \$149.
Mitrek, pl/dpl, 4 ch., 30 w., 450-470, \$395.
Radius, used, 2 ch., 25 w., 450-470, \$325.
Maxar, pl/dpl, 1 ch., recased, 30 w., \$295.
Mitrek, pl/dpl, 4 ch., 50 w., 450-470 \$495.
Mitrek, pl/dpl, 4 ch., 110 w., 450-470 \$875.
Mitrek, pl/dpl, 4 ch., 15 w., 800 \$275.
Mostar, trunked, 15 w., complete \$395.
Maxtrac, trunked, 15 w., complete \$495.
Traxar, trunked, 15 w., complete \$195.

Bases & Repeater:

Maxar, 1 ch., base mike, 10 w., 154.40 \$159.
Consolette, pl, w/mike, 45 w., 151.775 \$450.
Flexar, pl, w/mike, 15 w., 450-470 \$295.
Flexar, pl, w/mike, 30 w., 450-470 \$350.
Mitrek Sup cons, DC only UHF, 30 w. \$595.
Mitrek Sup cons, 4 tq, Local, 30 w. \$695.
Mitrek Sup cons, 800 conventional \$395.
Micor Repeater, pl, 1 user, 75 w. \$3,695.

Hundreds of OTHER units IN STOCK!

California Radio 16943 - 6200 Road
Montrose, COLORADO 81401

Orders: 800-231-0103 Fax: 303-249-4334

All other calls: 303-249-1414

G GENERAL COMMUNICATIONS



WHOLESALE PRICES ON ALL
MIDLAND RADIOS!
CALL TODAY!

MasterCard VISA
1-800-356-3200

5157 Anton Dr.
Madison, WI 53719

Accessories

QUALITY BEEPER COVERS & ACCESSORIES

Covers designed by master-craftsmen
with soft quality leather carefully prepared by tanning.

LARGEST selection • UNIQUELY designed

- Fully enclosed leather cases with hidden coin pouch
- Leather, Vinyl & Denim slip-on
- Introducing Charm & Chain and Neck Chain. Now available, company logo on Charm or Clip!

call: ALL GREY ENTERPRISING

718-946-4636
1-800-542-7485

"We Have You Covered"

Rentals

MOTOROLA RADIO RENTALS

- MT1000, HT600, P200
- Intrinsically Safe
- All Types Headphones
- Mobiles & Portapacks
- Repeaters & Crossband Sets
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.

P200
HT600
MOTOROLA
RENTALS
800-767-1963
MOSS COMMUNICATIONS, INC.

Repair services

M&M COMMUNICATIONS

103 W. Main St.
Youngsville, NC 27596
(919) 556-5999



BUY, SELL AND SERVICE ALL
AEROTRON TWO-WAY PRODUCTS
Authorized Service Center
5-day Turn • Same Day Shipping
Wholesale Parts • Quality Workmanship

\$25 2-WAY REPAIR

Motorola, Uniden, Standard,
Johnson, Midland and many more!

A.S.K. COMMUNICATIONS

1-800-827-0747

3837 E. Wier Ave., Suite #1, Phoenix, AZ 85040
Plus parts & shipping

TWO WAY RADIO REPAIR

Specializing in
REGENCY/RELM, WILSON, OTHERS

\$25.00/Hr. Plus Parts & Shipping
Fast Turnaround / Factory Trained
MULTICOM 1-800-798-5842
VISA MC 2501 NW 10th, Oklahoma City, OK 73107

We're Moving Ahead
to expand facilities.

1445 MacArthur Drive
Carrollton, TX 75007

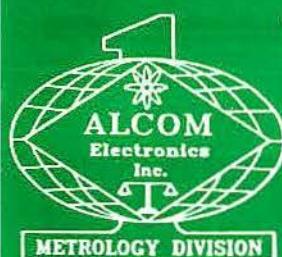
ELECTRONIC PAGING SERVICE PAGER REPAIR

Repair • Recrystal • Recode

- Flat Rate: \$10 plus parts
- Quick turnaround
- Computerized pager tracking system
- Contract rates negotiable

Same Phone #
(214) 242-1887

WE CAN SAVE YOU MONEY!



WE
TAKE TRADES
ON NEW OR USED
EQUIPMENT

WE CARRY A
FULL LINE OF
TELECOMM
INSTRUMENTS

RYCOM
FREQUENCY
SELECTIVE
VOLTMETERS
METRO TEL/DDI
TRANSMISSION
TEST SETS

DROP & INSERT
T1, DS1, DS2

DS3 & DS4

AVCOM

SPECTRUM
ANALYZERS

WECO, CABLES
AND ADAPTERS,
BANTAM ADAPTERS,
AND MUCH, MUCH
MORE...

ALCOM ELECTRONICS, INC. HAS A COMPLETE INVENTORY
OF REFURBISHED FREQUENCY COUNTERS, DISTORTION
ANALYZERS, SPECTRUM ANALYZERS, FREQUENCY
SELECTIVE VOLTMETERS, TONE GENERATORS, SERVICE
MONITORS, TRANSMISSION TEST SETS,

MICROWAVE POWER METERS & SENSORS, SWEEP GENERATORS
CHART RECORDERS, AND MORE...

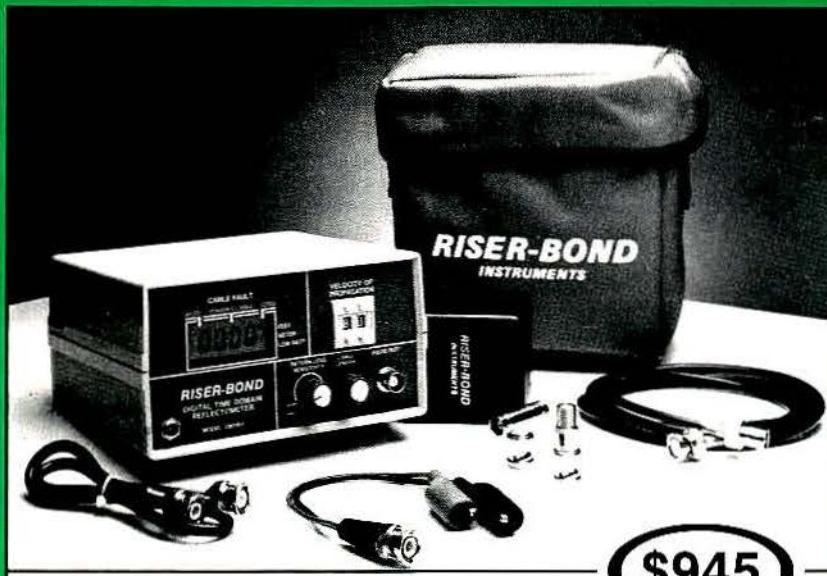
FAX YOUR REQUIREMENTS OR CALL
1-800-476-2526 — 24 HOUR FAX LINE 601-868-0133

ALCOM ELECTRONICS, INC.

2801 17TH AVENUE, GULFPORT, MS 39501

IFR
PRIORITY
SERVICE
AVAILABLE
24-72 HOURS

ALL TYPES OF
EQUIPMENT
AVAILABLE
HEWLETT PACKARD
TEKTRONIX
IFR
KIPP & ZONEN
CUSHMAN
MOTOROLA
MARCONI
JFW ATTENUATORS
ADC
PACE
B & K
FLUKE
WEINSCHL
WAVETEK
BOONTON
GENRAD
OPTOELECTRONICS
AND MANY, MANY
MORE...



\$945

DIGITAL TIME DOMAIN REFLECTOMETER
CABLE FAULT LOCATOR

MODEL
2901B+

SCOPE
OUTPUT
CAPABILITY

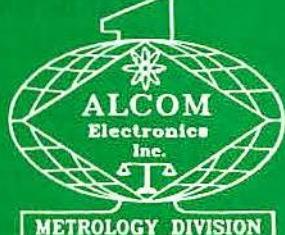
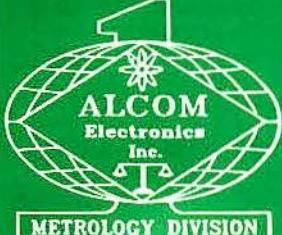
VARIABLE
SENSITIVITY
CONTROL

★ "an instrument you can find fault with" ★

WE REPAIR AND CALIBRATE ALL
MAJOR MANUFACTURER'S TEST EQUIPMENT
FROM DC TO MICROWAVE

ALCOM IS A FULLY STAFFED LAB THAT IS
N.I.S.T. TRACEABLE AND MEETS THE CALIBRATION
SYSTEM REQUIREMENTS OF MIL-STD 45662A
A MEMBER OF THE

Circle (148) on Fast Fact Card



NATIONAL CONFERENCE OF STANDARDS LABORATORIES

METROLOGY DIVISION

CUSHMAN SERVICE CENTERS

THESE ARE THE **ONLY** FACTORY AUTHORIZED CUSHMAN SERVICE CENTERS

TRITON ELECTRONICS, INC.
 4300 LINCOLN AVE., UNIT O
 ROLLING MEADOWS, IL 60008
 (708) 934-6426
 FAX (708) 934-7195

CUSHMAN ELECTRONICS, INC.
 2144 BERING DRIVE
 SAN JOSE, CA 95131
 (408) 432-8100
 FAX (408) 432-8359

NS ELECTRONICS SERVICE, INC.
 3610 DEKALB TECH. PKWY.
 SUITE 110/111
 ATLANTA, GA 30340
 (404) 451-3264
 FAX (404) 458-8785

New and Used Instruments Available.
 Models: 6030, 7120, 7130, CE15, CE200, CE201.

Circle (149) on Fast Fact Card



"The Pager Repair People"

High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola and NEC. WE NOW SERVICE PANASONIC.
 (303) 337-4811

PAGER/PORTABLE REPAIR

Low-cost conversion
 Discounts for quantity

Pager Repair: Flat rate-\$10 plus parts.
 Portable Repair: Flat rate-\$30/hr. plus parts.
 Maximum 2 hours.

Call Pager Communications
 for quotes: 1-800-955-1044

SERVICE MONITORS

Specializing in Service Monitors since 1973

- Repair and Calibration
- Buy, Sell and Trade



356 Hillcrest Street, El Segundo, CA 90245
 Phone (800) 288-8223 or (213) 322-3666

WARRANTY FOR USED TAC310 RADIOS

That's Right. We're offering a warranty for existing TAC310 mobiles.

For a flat \$75 fee we will provide:

- Minor repair - Testing - Tuning
 - Warranty of the basic transceiver for one year
- The radio's age is not important. We ask only that the mobile:
- Not be modified, damaged or misused
 - Be part of a licensed commercial system

*For more information on this unprecedented offer,
 call us today at 1-800-535-2082*



Kyodo West, Inc. • 200 Bursca Drive, Suite 100 • Bridgeville, PA 15017-1400 USA

Circle (150) on Fast Fact Card

Help wanted

FIELD/BENCH TECHNICIAN

A Wyoming Motorola MSS two way shop of 26 years seeks an experienced Two Way Field/Bench Technician. We service all major brands both conventional and trunking, new and old. Would like to have a FCC or NABER certificate but not mandatory. If you are looking for an opportunity in a successful and growing company send resume to:

Two Way Radio Service, Inc.
 418 North Conwell
 Casper, WY 82601
 (307) 237-9112

TWO-WAY RADIO TECHNICIANS

Portable radio technician and Field/Systems technician with experience needed by Motorola MSS. Full benefits, salary commensurate with experience.
 ELECTRONICS SERVICE CENTER, INC.
 127 Adams St., Ann Arbor, MI 48104
 (313) 662-1247 (800) 248-4455

Help wanted

CELL SITE TECHS SWITCH TECHS

National Openings for experienced Cell Site Maintenance Technicians, Switch Techs (EMX, DMS or Ericsson desired). But will consider any comparable switch training & exp. Locations in a number of expanding markets.

LAWRENCE PERSONNEL
 Box 10M
 King of Prussia, PA 19406
 215-783-5400 (Voice)
 215-783-6008 (FAX)

COMMUNICATIONS RECRUITMENT
 SINCE 1957.



MIDDLE EAST... KUWAIT... SAUDI ARABIA AFRICA... NORTH & SOUTH AMERICA MASTER TECHNICIANS... FIELD ENGINEERS 2-WAY... MICROWAVE... VSAT... SCADA

IWL Communications, Inc. is seeking highly-qualified, highly-motivated FCC-licensed Master Technicians and Field Engineers, with a minimum of 5 YEARS experience, for projects in the Middle East, Africa, and North & South America. We offer excellent salary and benefits (401K); international travel, hard work, and long hours required. IWL has offices in major Gulf Coast cities with operations worldwide. If you're an expert, please respond immediately with resume to:



COMMUNICATIONS, INC.



POB 1324 • Friendswood, TX 77546 • attn: Ken Fisher • (713) 482-0289

MARKETING MANAGER

We are a leading two-way radio manufacturing company seeking a qualified marketing manager. If you are interested in this position, please send resume and salary requirements along with three references to personnel office, P.O. Box 20286, Kansas City, MO 64153 by August 15, 1991.

Help wanted

RADIO TECHNICIANS

A leading provider of mobile communications service in the San Francisco bay area is looking for experienced technicians. Positions available for site, field and bench techs. Minimum of 3 years experience in mobile radio required. E.F. Johnson experience a plus. Excellent salary, medical, dental and retirement benefits, send resume to:

Department JU
26247 Research Rd.
Hayward, CA 94545

(916)973-8701
ECS

Executive Consulting Services

Executive Search Nationwide

- Engineering
- Management
- Sales
- Systems

2500 Marconi Ave. #306
Sacramento, CA 95821
FAX (916) 973-8775

SENIOR TECHNICIAN/MANAGER

Live and work in one of the nations premier vacation locations: MAMMOTH LAKES, CALIFORNIA. We are seeking an experienced self-directed technician/manager for our new Mono County, California service facility. Successful applicant will have FCC license/NABER certificate, and five years lead technician experience with a background in Motorola and/or Midland equipment. Escape the rat race and live in the mountains. Send complete resume to:

PAGE WEST, ATTN: Ric Karau
P. O. Box 11731
Reno, NV 89510

Services

SERVICE INSTRUCTION

38 lessons & tests written exclusively for mobile communications servicing. No Radar. No TV. Home Study. \$375. Time payments available. Established 1960.

Mobile Training Institute
528 Pacific Terr. P.O. Box E
Klamath Falls, OR 97601-0021

MTI

(503) 882-5408

HT600/P200 2 ch to 6 channel
CONVERSION \$40.00
Out of Band Modifications for
Radius Portables and Mobiles
Metrocom 718-392-3300

Services



Lightning Deterrent Corp.

Protect the Structure Outside
Protect Your Systems Inside
Space Age Technology



5321 South Kedzie Avenue
Chicago, Illinois 60632

312-434-7912 or 1-800-776-7150 Fax 312-434-0332

U.S. Pat. No. 4,605,814 Can. Pat. No. 1,205,614

Cellular services

DUPLEXER TUNING

Minimize your Losses
Maximize your Gains



D P ELECTRONICS, INC.
152 Floyd Avenue
Bloomfield, NJ 07003
(201) 748-6334

*Making The Connection
in Communications*

New software covering intermod, radio range, pathloss, swr calc., decibel calc. & more. 23 programs including subprograms. Complete package on 360k 5-1/4 IBM format disk: \$19.95.

Spartan Radio
P. O. BOX 15178
Spartanburg, SC 29302

PHILA., PA., So. Jersey \$250.00 Commission

Professional on-site installation \$125
Warranty service on all brands
ADVANCED CELLULAR OF PHILADELPHIA
800-233-0013 • IN PA 215-322-4600

Sales offices

PUBLISHER
Mercy Contreras
First National Bank Building, 333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249 Telefax: 303-762-0069

SOUTHERN REGION
Diane Hite, Marketing Manager
First National Bank Building, 333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249 Telefax: 303-762-0069

NORTHEAST REGION
Ruth Breashears, Marketing Manager
First National Bank Building, 333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249 Telefax: 303-762-0069

WESTERN REGION
Dennis Hegg, Marketing Manager
950 N. Gate Drive, Suite 207
San Rafael, CA 94903
Telephone: 415-491-1442 Telefax: 415-491-1842

MIDWEST REGION
Nancy Matthews
55 East Jackson Blvd., Suite 1100W
Chicago, IL 60604
Telephone: 312-435-2340 Telefax: 312-922-1408

CLASSIFIED SALES
Carla Gamino, Classified Marketing Manager
First National Bank Building, 333 W. Hampden, Suite 803
Englewood, CO 80110
Telephone: 303-762-1249 Telefax: 303-762-0069

EUROPE:
Nicholas McGeachin
Unit 3, Castle Farm Business Centre
Clifton Road, Deddington
Oxford, OX15 4TP UK
Telephone: 44 (0)869 38794 Telefax: 44 (0)869 38040
Telex: 837469 BES G

JAPAN:
Masahiro Yoshikawa
Orient Echo, Inc.
1101 Grand Maison
Shimomiyabi-Cho, 2-18
Shinjuku-ku,
Tokyo 162 Japan
Telephone: 33-235-5852 Telefax: 33-235-5961
Telex: J-33376 MYORIENT

Cellular services

CELLULAR REPAIRS

KEEP YOUR CUSTOMERS HAPPY!

Superior warranty facility
for 12 manufacturers

- 24-hour turn-around
- Extensive inventory for hard-to-get parts
- Non-warranty repairs

1-800-326-7901
ext. 101

Cellular Phone Services, Inc.
403 E. Gude Dr.
Rockville, MD 20850-1351



A index/hotline

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
AAT Communications Corp.	106	122	718-979-6600	Kustom Electronics, Inc.	61	55	913-339-6767
Advanced Electronic Filter	115	147	716-656-1105	Kyodo West Inc.	29,118	24,150	800-535-2082
Advanced Receiver Research	24	20	203-582-9409	Larsen Antennas	81	80	206-573-2722
Advanced Videotech Corp.	74	69	800-233-0013	Leathersmith	42	94	717-270-2910
Aer Aerotron	73	68	919-872-4400	Magellan Systems Corp.	49	40	818-358-2363
Air Communications	112	138	602-275-4505	Magnasync	78	76	213-962-0382
Alcom Electronics Inc.	117	148	800-476-2526	Maxon Electronics	23,80	19,79	816-891-6320
Alexander Batteries	94	96	515-423-8955	Maxon Systems, Inc.	69	64	800-922-9083
American West C&E	103	110	800-542-WEST	Maxrad, Inc.	27	22	708-595-3933
Antenex, Inc. Signal Prop System	70	65	800-323-3757	Mechem Electronics	114	144	703-373-3888
The Antenna Farm	110	130	800-255-6222	Meridian Communications	55	48	818-888-7000
The Antenna Specialists Co.	40	34	216-349-8400	Metrocom Services	114	145	718-392-8629
Astron Corp.	45	37	714-458-7277	Midian Electronics Inc.	100	105	602-884-7981
Automation & Electronics Engineering	112	136	214-238-9393	Midland International LMR	IFC	1	800-MID-LAND
Avcom of Virginia	52	45	804-794-2500	Mobile Mark, Inc.	101	107	800-648-2800
Beeper To Go	74	70	516-365-2337	Modular Comm Systems	100	131	903-860-3660
Bendix-King	85	85	913-842-0402	Motorola C&E	105	120	708-576-5484
Bird Electronics Corp.	102	108	216-248-1200	MX-COM, Inc.	9	9	919-744-5050
Bomar	8,114	8,141	800-526-3935	NEC America	13	11	214-907-4000
Cadex Electronics, Inc.	70	66	604-522-8046	Norton Engineering	108	125	703-938-5745
California Radio	109,116		800-231-0103	Omicron Electronics	82	82	203-928-0377
Carlson Communications	66	59	800-283-6006	Orbacom Systems, Inc.	17	15	609-829-4455
Cartwright Communications	63	57	513-489-1755	PageTek, Inc.	77		919-876-8294
Celwave	20-21	18	201-462-1880	Panavise Products, Inc.	93	74	702-353-2900
Centurion International Inc.	31,109	26,128	800-228-4563	Paragon Engineering, Inc.	84	84	800-368-0078
CES, Inc.	7	7	407-679-9440	Polyphaser Corp.	104	111	800-325-7170
CET, Inc.	56	50	904-426-0014	Positron Industries, Inc.	89	89	514-345-2200
Chargeguard Corp.	109	127	800-458-3410	Primus Electronics Corp.	66,76	60,73	800-435-1636
David Clark Company, Inc.	18	16	508-756-6216	Racom	86	87	216-351-1755
Coded Communications	58	52	800-228-6367	Radio Express, Inc.	114	142	703-266-1928
Communications Specialists	BC	3	800-854-0547	Radio Systems	95	97	305-587-9135
Communications Associates	83,114	83,143	800-435-9313	Radio Wholesale	115	146	404-561-7000
COMTELCO Industries, Inc.	68	62	708-790-9894	Ramsey Electronics	34	29	716-924-4560
Connect Systems, Inc.	19	17	800-545-1349	Ritron Inc.	33	28	317-846-1201
Control Signal Corp.	14	12	303-989-8000	Rocky Mountain Communications, Inc.	107,108		303-988-3395
CPI Communications, Inc.	78	75	800-869-9128	Scala Electronic Corp.	16	14	503-779-6500
CT Systems-Wavetek	35	30	800-245-6356	Schlumberger Technologies	15	13	800-225-5765
Cushcraft-Signals Corp.	67	61	800-258-3860	Securitron Company	12	10	408-263-6434
Cushman Electronics, Inc.	118	149	408-432-8100	Selectone Corporation	54	47	415-887-1950
Data Signal Inc.	32	27	912-883-4703	Setcom Corp.	62	56	415-965-8020
Decibel Products, Inc.	36,37	31,32	214-631-0310	Shure Brothers, Inc.	75	71	800-25S-HURE
Eagle Wichita	102	109	316-942-5100	Sigtone, Inc.	91	92	800-525-8663
Earmark, Inc.	76	72	203-777-2130	Skaggs Telecomms Service, Inc.	39	33	801-261-4400
EMR Corp.	50	41	602-581-2875	Skyline Antenna Mgmt.	106	121	203-673-0380
Ericsson GE Mobile Comms	43	36	800-GE1-2345	SMC Electro-Mount	90	90	800-527-1079
Executive Business Systems	108	126	216-662-1822	Smith Myers Comms USA	79	77	800-642-9512
Fanon Courier	113	140	714-669-9890	Softwright	107	124	303-329-6388
Gamber Johnson	60	54	715-344-3482	Solar Electric Specialties	90	91	707-459-9496
General Communications	111	132	800-356-3200	Solid State Communications	3	5	415-785-4610
GLB Electronics	80	78	716-675-6740	Sonic Communications, Inc.	86	86	603-878-1944
Haewa Corporation	52	44	800-783-4239	Southern Computer Corp.	113	139	800-752-3571
Doug Hall Electronics	50	42	614-261-8871	Sti-Co Industries, Inc.	48	39	716-662-2680
Harger Lighting Protection	30	25	708-362-4848	TAD Radio	92	93	509-326-1511
Henry Radio	51	43	213-820-1234	Telex Communications, Inc.	96	99	800-828-6107
Hewlett Packard	41	35	509-921-4001	Transcript International Inc.	5	6	402-483-2961
Hutton Communications	93,95	95,98	214-239-0580	Trident Micro Systems	57	51	800-798-7881
Hutton Communications	97	100	214-239-0580	Trylon Manufacturing Co. Ltd.	100	106	519-669-5421
HY-Q International	111	133	606-283-5000	TX RX Systems, Inc.	28	23	716-549-4700
ICOM America	59	53	206-454-8155	Unibel Developments Inc.	104	112	800-663-8731
IFR Systems, Inc.	47	38	316-522-4981	Unipage	25	21	800-367-2864
Industrial Comm Engineers	82	81	800-ICE-COMM	VCP International, Inc.	98	101,102	214-271-7818
International Crystal Mfg.	22		405-236-3741	VCP International, Inc.	99	103,104	214-271-7818
JaBRO Batteries Inc.	53,111	46,134	800-323-3779	Vega, A Mark IV Company	1	4	818-442-0782
Kenwood U.S.A. Corporation	65	58	213-639-4200	Vocom Products Corp.	56	49	800-USA-MADE
Kenwood U.S.A. Corporation	Belly Band		213-639-4200	Brian R. White, Co., Inc.	68	63	707-462-9798

All Yaesu
Land Mobile Radios
now carry a 3 Year
Parts and Labor Warranty.

vertex™

The Perfect Line.

The new 99-channel **Vertex** mobile (FTL-2011/7011-99) gives you the perfect line. This mobile radio is the latest addition to the growing **Vertex** line and another example of Yaesu's total commitment to quality, reliability and innovation.

The new 99-channel mobile radio meets the same exacting MIL STD 810 C/D specifications and strict quality requirements as the other **Vertex** models, including the popular 4-channel and 12/24-channel versions. All of which are available in UHF, VHF and Lowband Frequency Ranges.

Delivering powerful features, Wideband Frequency Spread and simple operation, **Vertex** mobile

radios are the choice of police and fire departments, government agencies, construction companies, forestry services and other demanding customers. In addition to the long list of standard features of the **Vertex** product line, the 99-channel model also has Digital Coded Squelch, Alpha Numeric and the most popular signaling formats built in as standard.

See for yourself why **Vertex** is the perfect line. Contact your nearest Yaesu USA dealer today.



YAESU U.S.A.

1990 Yaesu USA, 17210 Edwards Road Cerritos, CA 90701



Dynamite Discovery

Communications Specialists' latest excavation brings to light yet another dynamite discovery—our new dip switch programmable SD-1000. No need to tunnel your way through Two-Tone Sequential decoding anymore. We've mined this amazing unit! Now, for the first time, you can stock one unit that will decode all calls in a 1000-call paging system with $\pm .2\text{Hz}$ crystal accuracy. The EEPROM onboard memory can even be programmed for custom tones, and every unit includes group call. Universal switched outputs control your call light, squelch gate and horn. The SD-1000 can



also generate CTCSS and decode Two-Tone Sequential. Its miniature size of 2.0" x 1.25" x .4" is no minor fact either, as it's a flawless companion for our PE-1000 Paging Encoder. We ensure one-day delivery and our one-year standard warranty. Tap the rich vein of Communications Specialists and unearth the SD-1000 or other fine gems.



COMMUNICATIONS SPECIALISTS, INC.
426 West Taft Avenue • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. 1-800-854-0547